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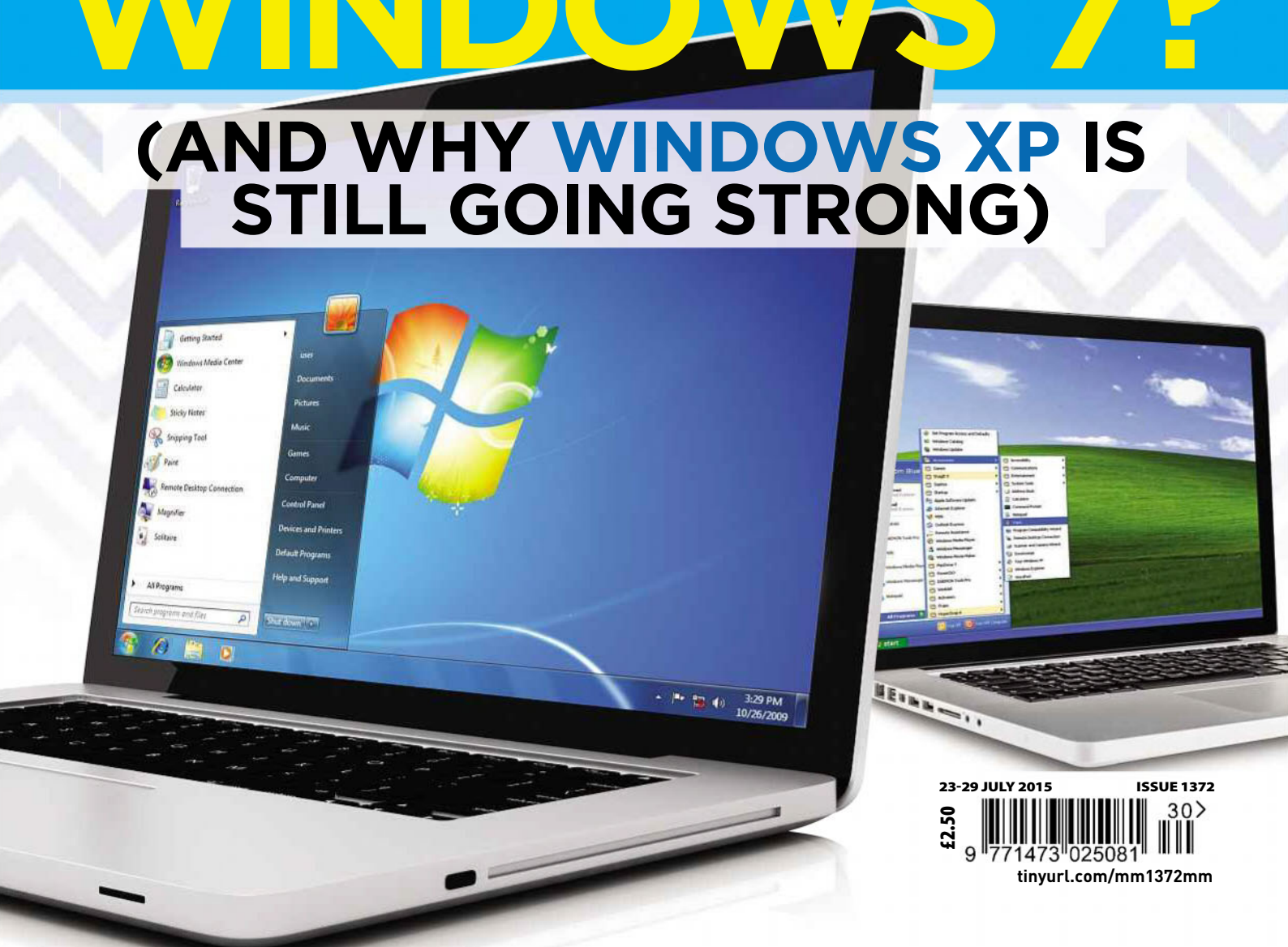

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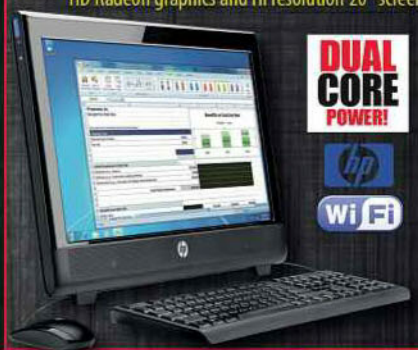

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Where Now For Windows 7?

(And Why Windows XP Is Still Hanging On Too)

David Crookes looks at Microsoft's plans for Windows 7 now that its latest operating is available

Microsoft's release of Windows 10 is just days away. It is the successor to the ill-fated Windows 8 and 8.1 operating systems and it has, in the upgrade process, skipped an entire number, as many of you will know. The company has kept quiet over the reason why it has done this, leading to speculation that it's because the number 9 is unlucky in Japan or that it's to do with an issue surrounding software checking for Windows 95 or 98. But the effect has been to put some distance between the new and old. The only problem is the old could so easily linger and bite Microsoft on the bum.

When Microsoft announced Windows 10, it said it would be available for free to anyone with an official copy of Windows 7 or 8/8.1. This was designed to make it easier to wipe the slate clean, get as many people as possible moving over and to lay down a new platform with a large userbase that can blow rivals such as Apple's OS X, Linux, Android, ChromeOS and all of the other pretenders clean out of the water.

Free is a good strategy for getting people switching (50% of Mac users switched to Yosemite within two months), so if Microsoft achieves anything like that percentage, it will be a job well done, especially because Windows has 1.5 billion daily users. But even though Apple and Android and so many others have gone down this route before, Microsoft's move has been met with scepticism. Why, many ask, is a company which has derived so much revenue from selling its operating system suddenly changing its tactics?

The motivation for this questioning lies behind Microsoft's assertion that Windows 10 will be free "for the lifetime of the device". It hasn't clearly defined what it means by this. Will it be free forever on that particular device or will Microsoft have its own figure on what a lifetime means? Will it make any difference if you decide to significantly alter your PC's innards: would that still fall under the terms of the original device, or would it be deemed to be new and thus invoke a Windows 10 charge from that point on?

Microsoft just isn't saying much beyond stressing that its business model

Windows 7 has a familiar user interface, which Windows 8 and 8.1 lacked

for Windows is not changing and that it will continue to charge licence fees for Windows through PC manufacturers (that is, for new machines rather than those being upgraded). It has dismissed talk of a subscription, saying it has "no plans to charge consumers" even though saying "no plans" doesn't actually rule it out forever more. Although it's most likely the case that Microsoft is instead looking to use Windows 10 to boost the uptake of Office 365, OneDrive and Windows Store apps, the uncertainty has been sitting in the back of many a user's mind.

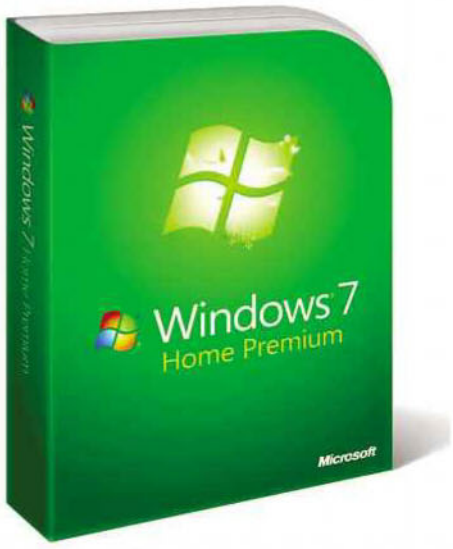
It would not, therefore, be too much of a surprise if users of Windows 7 decide that an upgrade to 10 is not for them at this present time. Windows 7 is seen as a solid, dependable, usable and enjoyable operating system, and users have shown great loyalty since it was released in 2009. In June this year, Windows 7 had a 60.98% share, according to netmarketshare.com, beating Windows 8.1 into second place with 13.12% and the perennial hanger-on Windows XP on 11.98%. Those figures are well ahead of Mac OS X Yosemite on 4.54%, but they also show the amount of work faced by Microsoft. An upgrade is available (Windows 7 users could have switched up to 8/8.1), but many choose not to go down that path.

But what of Windows 7? What is about to happen to it now that Windows 10 is finding its way to hard drives across the world? A billion devices run Windows 7, a figure close to the number involved with Windows XP around six years ago. This is the figure that Terry Myerson, Microsoft's executive vice president of the Windows and Devices Group, is predicting for Windows 10 in three years' time. But Windows 7 has continued to increase in popularity despite the looming launch of Windows 10: in June, StatCounter showed that 7's market share rose 0.6%, and Netmarketshare had a more optimistic figure, putting the Windows 7 share at 3.22. Much of this, experts suggest, has been to put people in a position to download the Windows 10 upgrade, but we won't know for certain for a few weeks at least.

What this has done is push Windows 7 into the popularity territory that XP once enjoyed. At its height, XP ran on 76.2% of all Windows PCs and everyone saw the effect of that years later. Last year, Microsoft ended support for Windows XP after 12 years and turned the OS into a zombie, sparking 'XPocalyse' headlines and effectively leading users towards a scramble to upgrade in order to protect themselves from security problems and a lack of technical support. A good many people moved to Windows 7 at great upheaval and cost, with staff having to be retrained and computers upgraded or replaced where it was necessary to do so. There were software compatibility issues, and many could not figure why they should upgrade when the existing system worked fine.

As if to underline that kind of thinking – and to show that it's not entirely Luddite but does have sensible origins – a 30-year-old Commodore Amiga was found to be controlling the air conditioning and heating of 19 schools in the Grand Rapids School district of Michigan. The programmer worked on the system as a teenager but lives nearby and is on hand to fix any problems. To upgrade to a newer OS and computer could cost as much as $2 million, so the decision has been made to keep things ticking over until it becomes absolutely vital to make the move. Many companies and individuals will think the same when it comes to Windows 7 (and indeed Windows XP).

"A billion devices run Windows 7, a figure close to the number involved with Windows XP around six years ago"



Windows 10 is set to be free, breaking the Microsoft tradition of always charging for its OSs

For those who decide to stand their ground and stay with an older system, there's some good news at least. Mainstream support for Windows 7 ended on 13th January this year, but it's now under the banner of extended support. This is set to end on 14th January 2020, which means users have a good four-and-a-half years before they have to make an XP-esque decision (those who are using Windows 8.1 can, incidentally, continue to benefit from mainstream support until 9th January 2018 and extended support until 10th January 2023).

Those who decide to stick with Windows 7 will therefore still be able to benefit from security patches but it does mean there won't be any feature updates over the coming years. "Extended support lasts for five years and includes security updates at no cost, and paid hotfix support," says Microsoft. "Microsoft will not accept requests for design changes or new features during the extended support phase." And when the extended support ends, that's it. No more security fixes unless it's absolutely vital (which is what happened a single time with XP), but that's still a good amount of time away to be worrying too much now.

Yet Microsoft doesn't plan on Windows 7 being around for much longer in real terms. It's keen to eat away at Windows 7's userbase, and it does not want significant numbers of people using Windows 7 come 2020, only to see lots of scare-mongering news reports and negative press about forcing people to switch up. The ending of support for XP could not have come at a worse time given the worldwide economy was still at an unhealthy stage, and while things should have improved by 2020, pulling the plug on people (many of whom don't keep up with tech so didn't see it coming) is always better if the numbers affected are as low as they possibly can be.

But it won't be easy for Microsoft. Windows 7 has cemented itself in the psyche of computer users to such a great degree that the appetite for a further change isn't always seen as desirable. Companies may be able to replace the OS with a freebie, but it's still treading into an unknown. With Windows 7 Professional, the IT departments of companies know they have an operating system that works – just like that Commodore Amiga works in America – and they don't want anything to jeopardise that. With Windows 7 Enterprise excluded from the free upgrade offer, companies may be reluctant to

XPocalyse Now

Last March, there was a faint whoop of jubilation from across the Atlantic as Microsoft executives celebrated what had been thought impossible: the laying to rest of Windows XP. It has become known as a zombie, the OS that could not be killed.

But fast forward more than a year after that 8th April cut-off date for support, and XP is still in existence and still being used – by 11.98% at the last count, which is a larger percentage than Windows 8, Mac OS X Yosemite, Vista and Linux combined.

For Microsoft, which wants rid of XP, things are getting better. Last April a third of active PCs clung to XP and Windows 7 accounted for just under half the market share. But the fact that people still use it rankles with Microsoft, and it's a victim of its own soaraway past success.

Another key date in the slaughter of XP occurred recently, on 14th July. That was the day when updates and new signatures for XP's built-in anti-virus tool, Microsoft Security Essentials, was axed. Yet still the lid remains off the coffin. Anti-virus experts Symantec says it will continue to support XP for the foreseeable future, and AVG will also continue to bolster the OS against attacks.

Windows XP is even being propped up by Google, which is rather delicious when you think about it. Mark Larson, director of engineering for Google Chrome said XP users should update to a supported, secure OS because, "at the operating system level, computers running XP are inherently in danger of being infected by malware and viruses, making it increasingly difficult for Chrome to provide a secure browsing environment."

But he added, "That said, we know that not everyone can easily switch to a newer operating system. Millions of people are still working on XP computers every day. We want those people to have the option to use a browser that's up-to-date and as safe as possible on an unsupported operating system." Google was due to end support for XP in April, but it will continue to provide regular updates and security patches to Chrome on XP through to the end of 2015.

There are some potentially serious consequences to the number of XP machines that are out there. In May this year, Government Digital Service said it would not be extending its £5.5 million deal with Microsoft to extend support for Windows XP even though it admits "weaknesses that are found in unsupported products will remain unpatched and will be exploitable by relatively low-skilled attackers." Individual departments will be free to negotiate their own contracts with Microsoft, but it's set to be more expensive since the collective bargaining has been lost.

"All departments have had seven years warning of the 2014 end of normal support, and this one year agreement was put together with the support of technology leaders to give everyone a chance to get off XP," says a post on the government technology blog. "The technology leaders met last month and took a collective decision to not extend the support arrangement for 2015. The current support agreement ended in April 2015. There has been good progress in moving away from Windows XP across departments and government organisations and with many public bodies this transition is complete."

The Guardian reported that NHS Scotland has 2,600 computers still running XP and that the Metropolitan Police Service has a staggering 35,910 machines with it installed. "The MPS has requested a direct option with Microsoft to continue a Custom Support Agreement for Windows XP for the next 12 months," a police statement said. Even HMRC still has a good number of PCs to shift over.

But it isn't simple for such organisations to switch. They tend to have bespoke systems with lots of data that would need moving over, together with information stored on individual hard drives that would need to be rescued before a switch could occur. Staff need retraining, and there's a fear of disruption and glitches as the transferring process gets underway. To keep things as they are is the least exhausting path, even if it does feel a tad lazy.

Yet it's not just the UK that's lagging behind in the switchover stakes. The United States Navy recently put to pen to paper on a $9.1 million one-year contract with Microsoft to continue supporting the 100,000 XP systems it has. We're sure Microsoft is under no illusions that getting people and organisations to move to Windows 10 in light of such revelations is going to be easy.

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▲ *Windows XP has been put out to pasture but is still well used*

Market Share	
Windows 7	60.98%
Windows 8.1	13.12%
Windows XP	11.98%
Mac OS X 10.10	4.54%
Windows 8	2.90%
Windows Vista	1.62%
Linux	1.61%
Mac OS X 10.9	1.44%
Mac OS X 10.6	1.54%
Mac OS X 10.8	0.43%
Mac OS X 10.7	0.43%
Windows 10	0.16%
Mac OS X 10.5	0.10%
Windows NT	0.08%
Mac OS X 10.11	0.03%
Mac OS X 10.4	0.03%
Windows 2000	0.01%
Mac OS X (no version reported)	0.01%
Windows 3.1	0.01%

call their Software Assurance plans to upgrade or make a purchase if they do not have it. The problem, though, is that Microsoft is introducing something that could throw a spanner in the works.

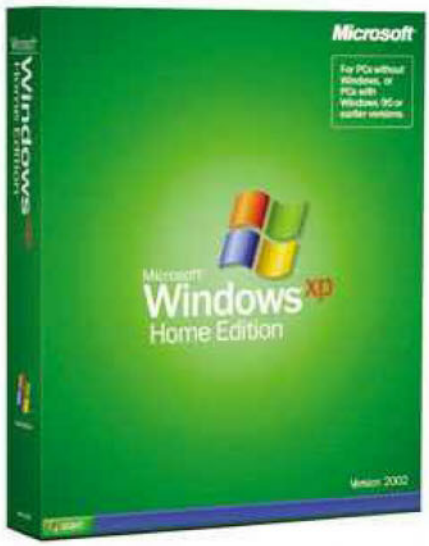
Whereas before, it was up to users to accept updates, with Windows 10 the decision is taken away: everyone has to allow them on to their systems, so if Microsoft wants to put something on there, then it can. "Windows 10 Home users will have updates from Windows Update automatically available," Microsoft says on its specifications page (www.microsoft.com/en-us/windows/windows-10-specifications). Professional users are also affected, but "Windows 10 Pro and Windows 10 Enterprise users will have the ability to defer updates."

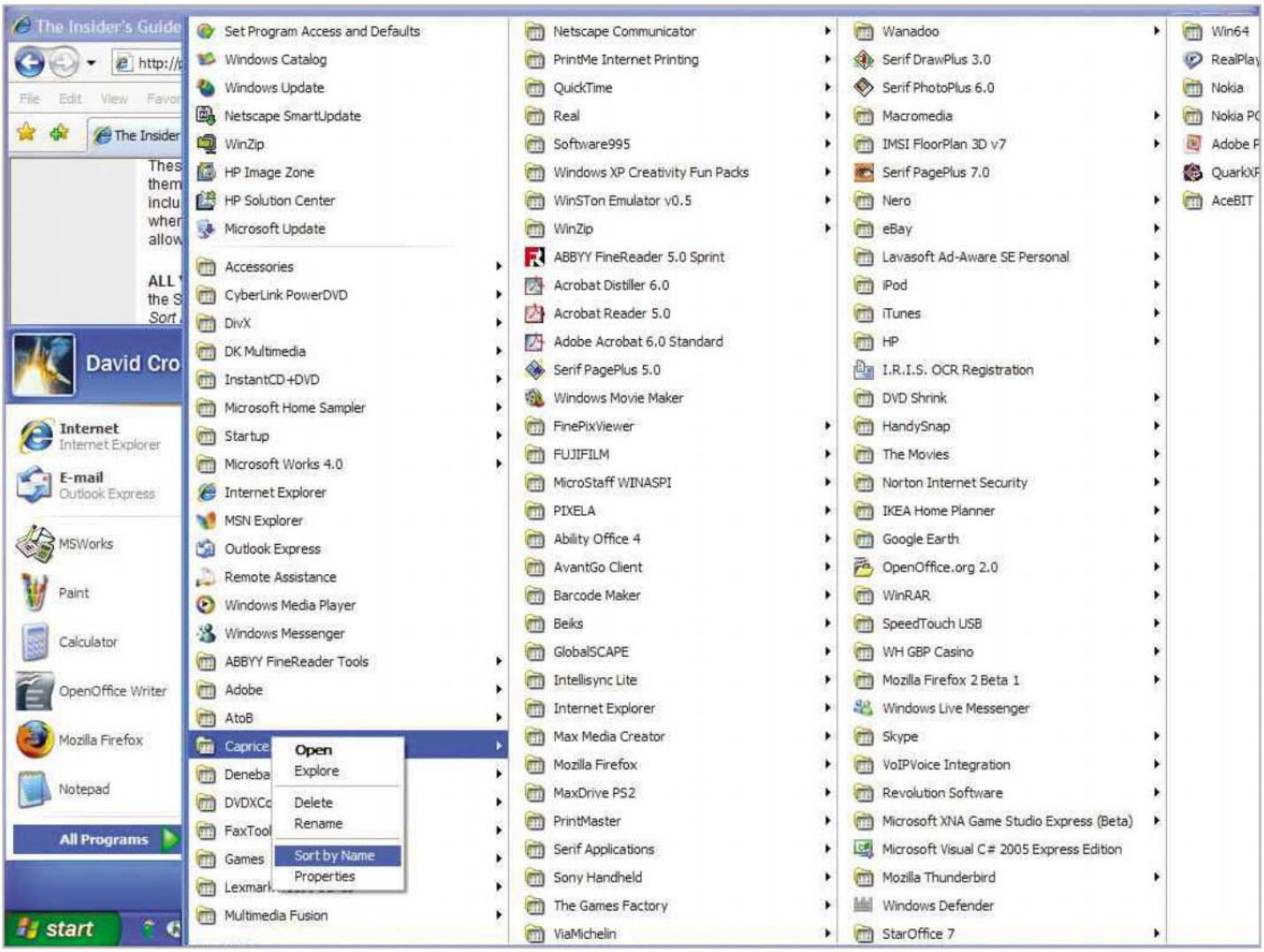
For home users, removing the ability to control what can and cannot be installed has not gone down well, and it has become an issue that may well persuade some to hang fire with Windows 7 a while longer. Even though "early adopters" can choose to see the new features straight away and ordinary users get them a few weeks later once obvious bugs are ironed out, the feeling of intrusion is a stark one. It's no less painful for business users, who may know that the updates can be deferred (most likely to ensure they're not bringing down computers left, right and centre), but that's only putting off the inevitable. What if an update ruins something they very much depend on?

Microsoft seems to have the answer for business users at least. The updates sent out for Windows 10 home users will act as a testing ground for the corporates. The details were spelt out in a blog post by Jim Alkove, the director of program management at Microsoft, which were picked up on by Gordon Kelly at Forbes.com. "We are introducing a new approach for business customers, which we are referring to as the Current branch for Business," Mr Alkove began.

"By putting devices on the Current branch for Business, enterprises will be able to receive feature updates ***after their quality and application compatibility has been assessed in the consumer market*** [emphasis Micro Mart's], while continuing to receive security updates on a regular basis. This gives IT departments time to start validating updates in their environments the day changes are shipped broadly to consumers, or in some cases earlier, if they have users enrolled in the Windows Insider Program. ***By the time Current***

"Mainstream support for Windows 7 ended on 13th January this year but it's now under the banner of extended support"





Many have stuck with XP for the programs, which in some cases do not run as well on later operating systems

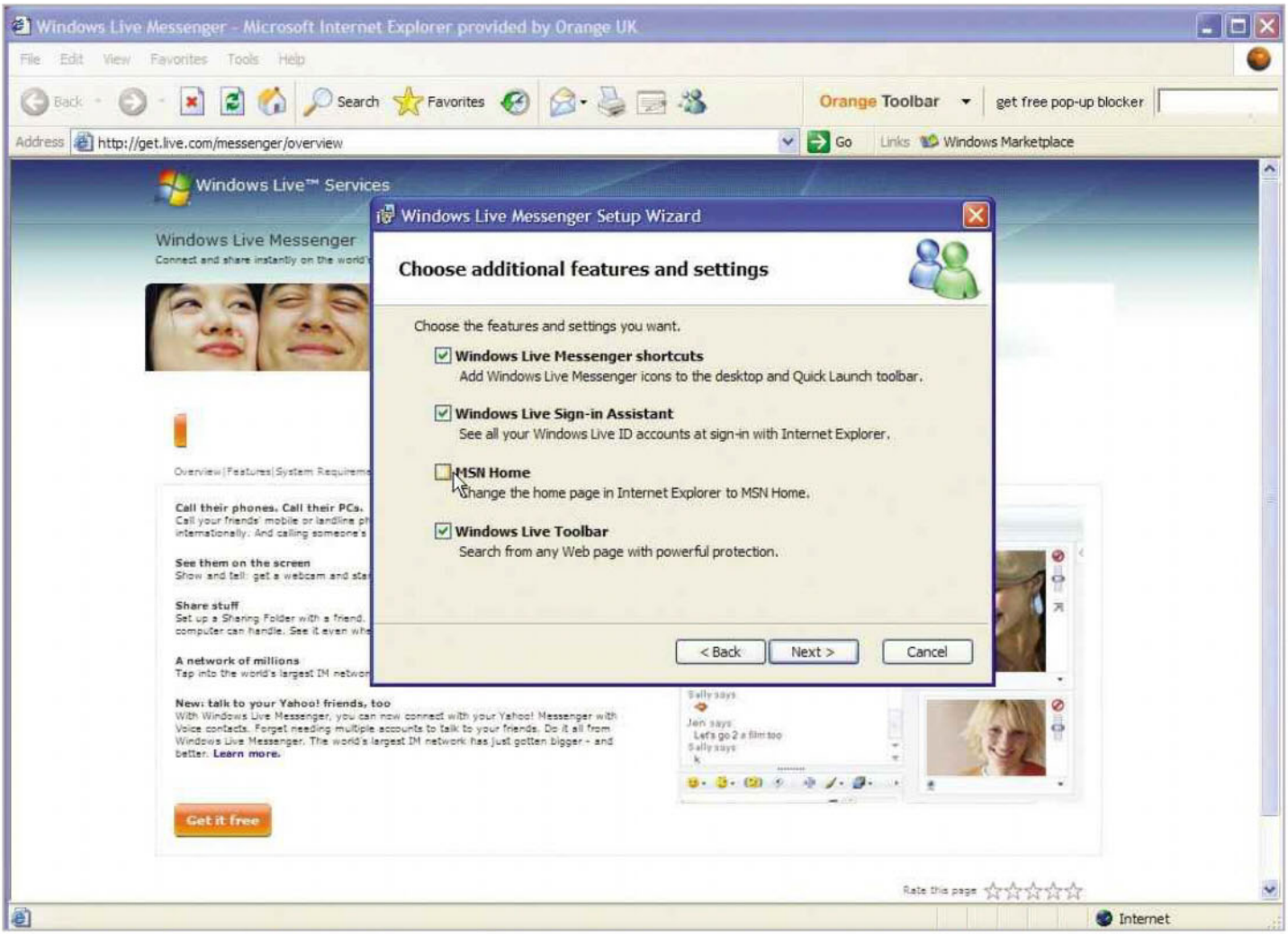
branch for Business machines are updated, the changes will have been validated by millions of Insiders, consumers and customers' internal test processes for several months [again, emphasis Micro Mart's], allowing updates to be deployed with this increased assurance of validation."

In a nutshell, that means that Microsoft will see if any problems are spotted during home use of Windows 10 updates, and only then will they be rolled out to the customers that really matter. It makes sense – businesses could be crippled by a rogue update – but it doesn't really leave home users protected, especially when the update just appears. This doesn't happen with Windows 7 and 8.1, because users are able to determine how they want the updates to be installed – with an option

7 Things To Discover About Windows 7

It's never too late to learn new tricks, so before you migrate away from Windows 7, take a look at what you could have been doing.

1. Pressing Shift before clicking an icon in the enhanced taskbar to open a new instance. This works even if you already have windows from that app open.
2. Giving people a visual hand when trying to show them how to fix a problem. If you type 'Problem Record' in the search box of the Start menu, you can access the Problem Steps Recorder too that takes a snapshot of the screen whenever you click.
3. Making life easier for your eyes. By going to the Control Centre, typing 'cleartype' and clicking Adjust ClearType text and then turning it on, you can get clearer, more readable text on LCD monitors.
4. Enabling virtual wi-fi to turn a Windows 7 machine into a software-based router. It needs a supporting wireless adapter driver, but it's a neat little trick.
5. Acting like a god with the God Mode, which allows you to locate everything within a single folder. Create a folder called Foldername.{ED7BA470-8E54-465E-825C-99712043E01C} to see lots of shortcuts.
6. Doing sums with the enhanced calculator that is found in the view menu and comes with lots of useful functions from fuel mileage to date calculations.
7. Creating quick word processing documents using WordPad. It will let you open and save ODT and DOCX files, which is handy if you don't have a OpenDocument Text compatible word processor or Word installed.



for never if need be. But even then trouble can come calling.

An update for Windows 7 in December had to be withdrawn when some users complained it was blocking the installation of software containing digital signatures. A second update had to be issued to remove the first from affected machines.

Microsoft's intention is to try to demolish the Windows 7 userbase that, at one time, it fought to hard to build, so it doesn't eat away at its resources and cause a problem in 2020. At the same time, it's committed to supporting it until 2020, which throws those who love it a lifeline. For those buying a new PC, though, Windows 10 will be the only option in the future (that said, Hewlett Packard does not think it will have Windows 10 preinstalled on computers until "mid-August to October"). That's because Microsoft set a deadline of 31st October 2014 for OEMs to stop building new PCs containing Windows 7 Home Premium.

> **"Microsoft does not want significant numbers of people using Windows 7 come 2020"**

When problems like that are shown to surface even on operating systems that have been around for years, it makes the job of budging a good wedge of users off Windows 7 and on to Windows 10 all the harder, especially when auto-updates are brought into the equation.

It will be interesting to see what happens from this point on, then.

What happened around that date shows the life Windows 7 may still have in it. The manufacturers knew that pulling pre-installed Windows 7 machines would cause consternation, which is why Dell tried to whip up sales of Windows 7 machines before the axe fell. Microsoft then said the date was posted in error: "We have yet to determine the end of sales date for PCs with Windows 7 preinstalled."

But that's because the only alternative was Windows 8/8.1, which Microsoft was struggling with. Windows 10 is different. This time, it really could be a make or break moment for the Windows OS, and if people are still talking about the benefits of Windows 7 and if they're getting upset at the prospect of it becoming a zombie in 2020, then Microsoft will have failed. To prevent that, it will be spending millions of marketing dollars promoting the upgrade path. Whether it works and what it would mean for Windows 7 remains to be seen. **mm**

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Broadwell On The Desktop

Mark Pickavance looks at the new fifth-generation Intel Broadwell processors and what new things they bring to the PC party

The first Intel processor I owned was a 80486DX that ran at 25MHz and had tracks that ranged in thickness from 1000 down to 600nm. I mention this because it's worth considering how far the last 26 years have taken chip fabrication and capabilities, to now bring us a 3.3GHz quad-core, octo-thread-crunching chip fabricated with tracks just 14nm wide.

But the path here hasn't been exactly smooth all the way, because making features that small built from atoms that are just 0.2nm across isn't straightforward. And,as we go smaller, it gets tougher to make chips that work reliably and at a high enough yield to make commercial sense.

These are just some of the challenges that Intel faced with its fifth-generation Core series processors for desktop PC and why they're late, atypically for Intel.

Broadwell That Ends Well

It's now been more than six months since I covered my first Z97 chipset motherboard for Intel, and only now are the processors intended to accompany them arriving. But 'Broadwell', a replacement for the exiting Haswell, has had something of a difficult journey to release.

This revamp is a 'tick' in Intel's alternating tick/tock product cycle, and it was therefore first intended for release in 2014. Technically it did first make an appearance nine months ago, or rather Core-M variations (Broadwell-Y) did.

These weren't remotely like anything you'd want on a desktop PC, as they were clamped to 4.5 watts and made to power laptops and tablets.

> **"There has been much debate in both technical circles and among Wall Street analysts, surrounding why Broadwell generally was so late"**

Road To Broadwell			
Microarchitecture	**Fab scale**	**Tick or Tock**	**Release Year**
Conroe/Merom	65nm	Tock	2006
Penryn	45nm	Tick	2007
Nehalem	45nm	Tock	2008
Westmere	32nm	Tick	2010
Sandy Bridge	32nm	Tock	2011
Ivy Bridge	22nm	Tick	2012
Haswell	22nm	Tock	2013
Broadwell	14nm	Tick	Core-M: Q4 2014 Mobile:Q1 2015 Desktop: Q3 2015

From the outset Intel promised that once the mobile chips started to flow, the desktop components would be coming soon. However, these chips had originally been scheduled to arrive in Q3 2014, and they've only just been released. It's also worth noting that the majority of Core-M options weren't immediately followed by the full mobile chip parts (Broadwell-U); they only slouched into view in Q1 2015.

These chips were design for Ultrabook's, mini-PCs and all-in-one configurations, with an initial power budget of 15 watts. Intel also promised 28W and some 47W high-performance parts.

Mobile platforms based on these chips have seen significant improvements in battery life over previous Haswell architecture, but these flagship Broadwell-U designs have only just started to appear in the latest hardware releases.

But for being fashionably late, that award goes to the desktop part, Broadwell-H, arriving now and in a very limited chip choice selection.

There has been much debate in both technical circles and among Wall Street analysts, surrounding why Broadwell generally was so late.

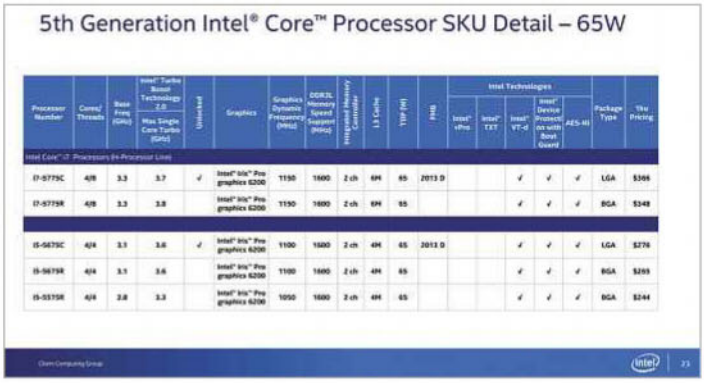
There are generally two points of view, neither of which Intel has been in any great rush to confirm. One side contends that 14nm on a part as complex as a desktop part and its associated GPU was more difficult than Intel had anticipated. But given that mobile parts are almost as complicated, that seems to be only part of the story.

In late 2014 Intel did admit that yields of the new 14nm parts weren't at the level it was really happy with, although at that point it must have been good enough on Core-M parts to start shipping them.

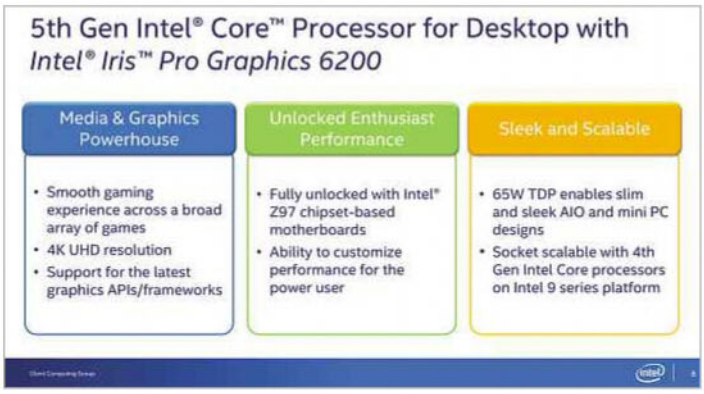
The alternate view is that given the dip in the market that the rise of tablets and the failure of Windows 8.x introduced, the delay was a strategic choice. Logically there seems little to be gained from bringing new technology to market early if people aren't buying PCs.

The truth probably lies somewhere between these two viewpoints, where 14nm was a tough die shrink and Intel gave itself some product release leg room.

However it happened, Broadwell desktop parts are here now, so are they worth getting excited about?



The selection of fifth-generation chips for the desktop is initially quite limited, but hopefully it will become more extensive once the 14nm process is bedded in



Broadwell-H

After the 'Y' Core-M and mobile 'U' variations, the 'H' desktop parts are designed to fit into the familiar LGA 1150 socket and bring a selection of new and enhanced features to the PC enthusiast.

Technically, the correct naming convention should call these parts Broadwell-DT, so I'll use that from this point onwards, so you know I'm talking about desktop chips.

In the launch selection are two Core i7 and three Core i5 designated chips, although of these only two are socketed and the other three are for BGA surface mounting. They all feature the new Iris Pro HD 6200 GPU and its associated new Crystal Well L4 cache technology using on-chip eDRAM.

The big difference between Core i7 and i5 in this instance is that the Core i5 lack Hyper-Threading on their quad cores and their clock speeds are marginally less than their i7 counterparts. There's also 6MB of L3 cache on the Core i7 and 4MB on the Core i5.

Of the new features, undoubtedly the flagship component is the new graphics engine Iris Pro Graphics 6200, designed to counter the general view that Intel's integrated video isn't much use for gaming.

The problem with on-chip video is that it's usually wired to use main system memory to do its work, and whatever clock speed you get DDR3 to, it's never quite as impressive bandwidth-wise as the GDDR5 favoured by discrete video card makers.

Intel's solution is to include a cache of very high-speed eDRAM on the chip (128MB in the HD 6200 spec) and to boost the graphics processing units from 20 on the older HD 4600 engine to 48 on Iris Pro Graphics 6200.

This isn't really like an AMD or Nvidia GPU upgrade where they design an entirely new processing engine or rendering

method. The new GT3e version of the existing GT2 video technology has just been allowed more transistors to do more of what it does at the same time.

There's an obvious comparison with the AMD APU line, though that's not really found much favour with desktop PC builders. However, those chips are CPU compromised to achieve their GPU powers, and Intel isn't taking that path with Broadwell. The complementary natural of its design is well explained by the L4 eDRAM cache, which research tells me is actually wired to both the CPU and GPU in Broadwell, and if you use discrete video it frees up the whole 128MB for the CPU to use.

> **Logically there seems little to be gained from bringing new technology to market early if people aren't buying PCs**

The top-tier chip in each Core has a 'C' class designation, which seems to be Intel's new 'K' generation, in that they're unlocked. 'R' means locked and possibly not socketed, if you didn't already guess.

That creates the slightly odd scenario in the case of the most expensive chip, the i7-5775C. It's technically 100MHz slower in Turbo mode, and identical at 3.3GHz to its cheaper i7-5775R brother. And the GPU on the i5 has a 50MHz higher top speed too, although it lacks Hyper-Threading.

What's currently missing are the high-end designs that topped out the Haswell selection eventually, where Core i7 Extreme was given 140 watts and others using 80 or 84 watts.

The highest clock Intel has on Haswell is the i7-4790K with a base of 4GHz and a Turbo of 4.4GHz. One might reasonably presume that Broadwell-DT should be able to better those settings, given its reduced power demands.

So in summary: four cores, Hyper-Threading if you can afford it, a lot more graphics than we're used to from Intel, and it all runs in 65 watts.

Proof And Pudding Time

Installing the i7-5775C that Intel kindly sent me to test required that I install a BIOS upgrade on my ASRock Z97 Pro 3 motherboard before proceeding.

Actually, it worked without it, but I installed it anyway so that the correct identification was made and all the voltages would be right. To be accurate, my tests were done on an engineering sample emblazoned with the words 'Intel Confidential', though I'm assuming there is no significant difference between this and the retail part.

I decided to use Windows 10 Pro Insider Preview 10162 as my OS, because from all accounts this is remarkably close to the RTM version, and seems generally stable.

With the focus more on the GPU side of the equation, rather than the CPU, I installed a series of generally available benchmarking tools on the test rig to see what the i7-5775C could do when put through its paces.

Synthetic Benchmarks

For comparison I've used my working platform, which has a Core i5-4430 3GHz and identical speed RAM. I would have used an i7, ideally the i7-4770 3.4GHz as the closest chip from the Haswell generation, but one wasn't handy.

On clock my i5 is 10% slower, it uses the HD 4600 GT2 GPU, and it has 84 watts to play with, an additional 19 watts more than the Broadwell chip.

Equally AMD couldn't be bothered to send me its last APU, so I don't have that for comparison either, sadly. From what numbers I've collected from elsewhere, Iris Pro is better than what AMD puts in its A10 series, and the processor is certainly much, much stronger.

Rather than focusing on pure number-crunching tests, I've pulled out a few benchmarks that mostly combine processing and graphics combined.

Cinebench 15

This is a good test for the new Broadwell CPU, because it uses multiple threads allowing the chip to better utilise all four cores and Hyper-Threading.

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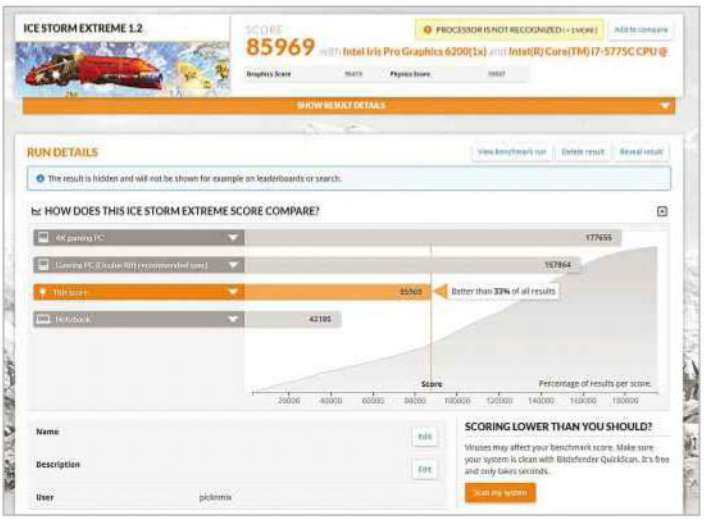

In a like-for-like comparison, a single core of the new chip is about 7% quicker than a single Haswell core, and this scales over to multi-core well. That using all cores the i7-5775C managed to achieve a score of 781, only 41 points away from an i7-4770K at 4.4GHz, is testimony to what improvements have been made.

By comparison by lowly Core i5-4430 managed just 124 in the single-core test, compared with 151 on Broadwell, and 448 on multi-core versus 781. The multi-core score is skewed by Hyper-Threading, but the single core is 12% better even when you normalise for clock speed differences.

I also tested with the older Cinebench 11.5, and it delivered very proportional results.

Futuremark 3DMark

Futuremark's 3D Mark offers lots of testing potential, and I have lots of data from various platforms for comparison.

Rather than walk through each test, here's a grid showing what this chip can do across the board and then some numbers from previous tests.

	i7-5775C	i5-4430	G3258 + R7 260X
Clock/Turbo Speed	3.3/3,7GHz	3/3.2 GHz	3.2GHz
Cores/Threads	4/8	4/4	2/2
GPU	Iris Pro 6200	HD 4600	R7 260X
Tests			
Fire Strike	1690	776	3361
Sky Diver	6751	3668	9427
Cloud Gate	13206	6557	6110
Ice Storm Extreme	85969	34977	59006

These are really interesting results, because you can see clearly the point where the tests shift from being GPU bound to CPU limited. With the Fire Strike test the new GT3e architecture still isn't enough even with the superior CPU power pushing it.

However, by Cloud Gate the graphical side of the problem is much less, and the chip performs significantly better.

What's rather troubling, though, is the Fire Strike score when compared with a very modest discrete card and low-spec dual-core CPU, showing the big gap that still remains between discrete and integrated video capabilities.

Futuremark PCMark 8

With limited time I decided to just do one of the PCMark 8 tests, seeing what I could learn from the Home test that combines a wide range of computing challenges.

	i7-5775C	i5-4430	G3258 + R7 260X
Clock/Turbo Speed	3.3/3,7GHz	3/3.2 GHz	3.2GHz
Cores/Threads	4/8	4/4	2/2
GPU	Iris Pro 6200	HD 4600	R7 260X
PCMark 8 Home 3.0 Accelerated Score	4121	3158	**4878**
Video Chat Encode v2	51ms	78ms	**33ms**
Video Chat Playback	**30.03fps**	29.97fps	29.9fps
Casual Gaming	65.46fps	26.97fps	**102.22fps**
Web Browsing JungePin	0.31343s	**0.30042s**	0.30439s
Web Browsing Amazonia	0.13425s	**0.12388s**	0.13309s
Writing	3.32947s	5.50217s	**2.91963s**
Advanced Photo Edit	0.21866s	0.24581s	**0.18436s**

Again, even with a scope of tests, the numbers were always going to be influenced by gaming speed, at which the Iris Pro 6200 is good, but not great when compared with almost any discrete solution. And for most other things, like web browsing and video chat playback it's much of a muchness.

What these numbers do demonstrate well is how much better than the old HD4600 GT2 model the new GT3e is, though only when the task is more demanding than archetypal surfing habits.

WPrime

I couldn't really cover a processor without throwing out a pure processor test, just to see what impact the L4 eDRAM has on computing performance. What's important to realise with wPrime is that a smaller number is better, as it's completed the calculations faster.

	i7-5775C	I7-4770K	i5-4430	G3258
Clock/Turbo Speed	3.3/3.7GHz	3.5/3.9GHz	3/3.2 GHz	3.2GHz
Cores/Threads	4/8	4/8	4/4	2/2
1024M Test	206.812s	208.533	380.651	914.618s

What really helped explain this story better was that I had some data from the i7-4770K, a Haswell processor that is priced remarkably near where the i7-5775C will land.

Obviously the G3258 wouldn't come anywhere in this race, if it wasn't last. The i5 is limited by not having Hyper-Threading, leaving the two Core i7 to duke it out.

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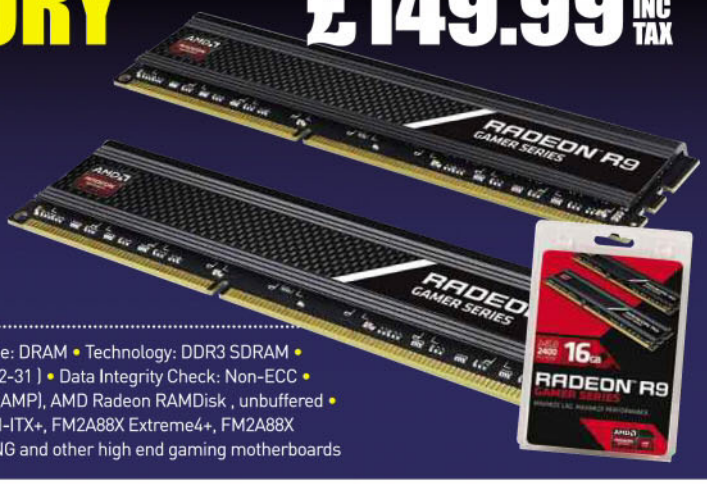

SPECIFICATIONS GENERAL Capacity: 16 GB : 2 x 8 GB •Upgrade Type: Generic **MEMORY** Type: DRAM • Technology: DDR3 SDRAM • Form Factor: DIMM 240-pin • Speed: 2400 MHz (PC3-19200) • Latency Timings: CL11 (11-12-12-31) • Data Integrity Check: Non-ECC • Features: Intel Extreme Memory Profiles (XMP), dual channel, AMD Memory Profile Technology (AMP), AMD Radeon RAMDisk , unbuffered • Voltage: 1.65 V **COMPATIBILITY INFORMATION** Designed For: ASRock FM2A75 Pro4+, FM2A78M-ITX+, FM2A88X Extreme4+, FM2A88X Extreme6+, FM2A88X-ITX+ ¦ Gigabyte G1.Sniper A88X, GA-F2A88XN-WIFI ¦ MSI A88X-G45 GAMING and other high end gaming motherboards

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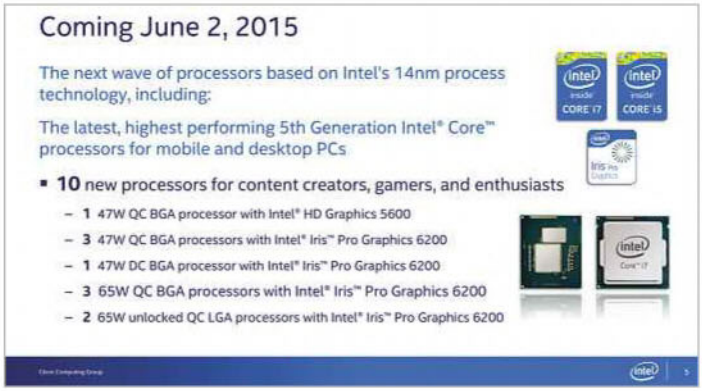
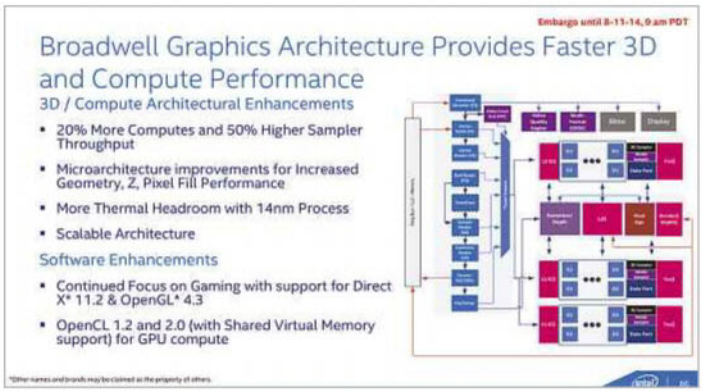


The good news is that Broadwell is here at last, and the bad news is that there are only two socketed LGA1150 processors initially, and the fastest baseline clock is 3.3GHz.



In baseline clocks the I7-4770K has 200MHz or about 6% more clock speed, though it manages to be 1% slower. That equates to between 6-7% more power from the same clock approximately, which is a modest improvement in processing power.

Typical Gaming

Along with the usual roster of benchmarks, I also played a few popular titles to get a feel for where this GPU would fit in the greater scheme of things. I was pleasantly surprised by how well the Iris Pro 6200 performed, because for lots of less demanding titles it's fine.

A good example was *World of Tanks*, as it has decent draw distance on some maps, and quite complicated models of the armoured vehicles.

Using 1080p resolution as the objective, *World of Tanks* recommended 'High' settings, incredibly. I tried this and while it did manage 25-30 fps, moving to medium got closer to 40fps and superior playability. Considering that on HD 4600 I'd recommend dropping to 1280 x 1024 or using 'low' to make it workable, that's a big difference in expectations.

However, with identical settings, the lowly G3258 and discrete R7 260X managed 65-70fps in *World of Tanks*, underlying how games are generally GPU bound these days.

Performance Conclusions

Three tests do not make a thorough analysis any more than a single swallow makes a summer, but there are some useful nuggets of information even in here.

It's very obvious that compared with Intel's previous efforts, the new GPU architecture is easily 50% quicker, and very often it's double the speed, depending what it's being asked to do.

Conversely, the CPU improvement is modest at probably 5% to 7% at best. At these relatively low baseline clocks, there are a good number of existing Haswell designs that could beat the i7-5775C, like almost all the Core i7 chips that are 3.6GHz and above, unless it's a graphics test.

Overclocks

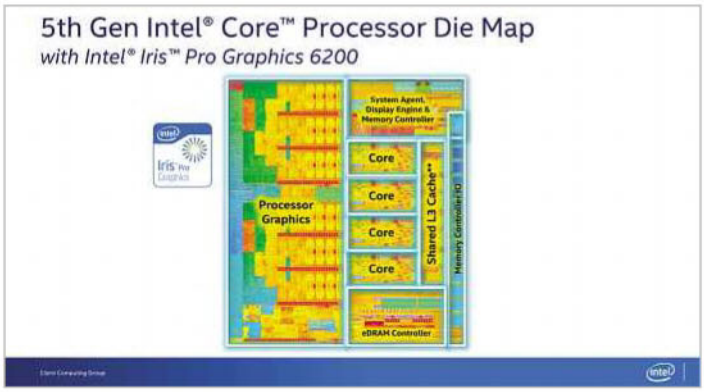
I didn't really have the time to explore overclocking comprehensively, but what I did learn from the few experiments that I ran was that the constraints of 65 watts do cause some problems when you want to get well above 4GHz.

But surely, you just give it more power, I hear you all shout. Yes, you can, but there are some protections built into the chip that seem intent on you giving it too much, and at this time they seem to want to spoil the fun.

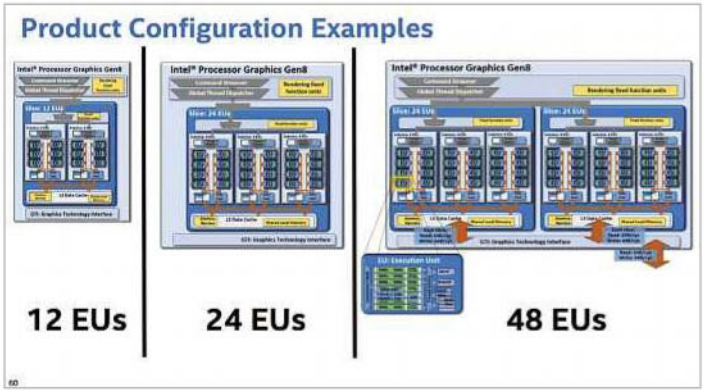
It may be that there needs to be some changes made at a BIOS level to disable these, with suitable warnings, to grease the wheels of this wagon. I know some motherboards have these BIOS modifications already, and I've seen at least one enthusiast who's taken this chip to 5GHz purely on air cooling alone.

If you're not prepared to unleash the hounds of modification on the Broadwell, there are some other benefits to the 14nm processor that soon become apparent.

For general office use this is a great processor, because with a good quality cooler mine never got above 35°C, where the ambient air temperature in the office was 25°C. That makes for a very quiet computer and longer component life.



The layout of the new Broadwell desktop processors allocates more space to the GPU and even finds space for an eDRAM controller. But if Intel had stuck with the original GT2 arrangement, that might have allowed for more CPU cores or a significantly bigger L3 cache



Broadwell's new GPU powers scale depending on the type of work they're expected to do. The desktop parts get the biggest and best design, with no less than 48 Execution Units delivered in two mirrored 'slices'

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Thanks to this feature, FreePC can works with an external 3G modems. It means that thanks to this device and 3G modem, you can browse the Internet always where you in range of your mobile operator network. You can also easily connect external hard disk, pendrive or other accessories like mouse or keyboard.

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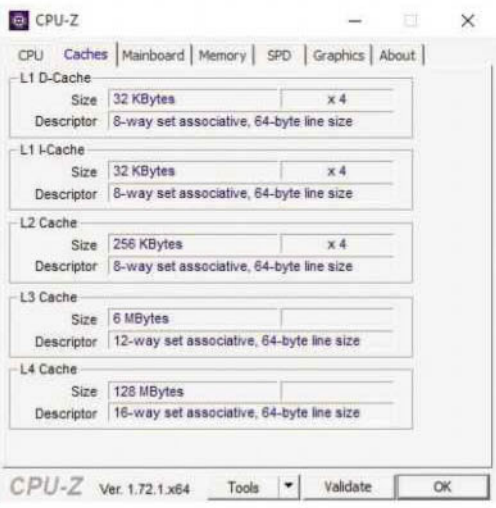

In GPU terms the new Iris Pro is at least double the processor that it replaced, but that still only makes it equivalent to a Nvidia GT 740 or AMD R5 240 in discrete graphics terms

The biggest change in CPU technology is that the Broadwell includes L4 eDRAM, able to provide support to both GPU and CPU processing

Until the motherboard makers get a proper handle on how best to handle this chip in their microcode, then we won't be seeing the silly numbers that I estimate are in this die – something to look forward to, I'd suggest, rather than anything to be overly concerned about now from.

Final Thoughts

From the testing I've done these, are really nice processors that deliver a noticeable improvement in integrated GPU capabilities and a less exciting lift to the CPU side of the equation.

As a rule, a die shrink usually nets you a 5-10% performance kick, and that's almost exactly what's on offer.

Intel needs complimenting for not doing anything silly with the LGA 1150 socket to make these chips fail to work on anything other than 9 series motherboards (Z97 and H97). From what I understand, and I haven't had a chance to test this, these chips will work on some 8 series boards. I'd check with your board maker, because if your 8 series platform is supported it will probably need a BIOS upgrade to correctly identify the new chip.

That backwards compatibility reveals that what Broadwell is mostly about is taking the Haswell architecture and scaling it down to release some power and thermal efficiency benefits. Not that you should turn you nose up at that, at all.

There are some major improvements, especially in the context of the integrated GPU, but most people will be slightly disappointed with the CPU gains.

I'm curious how much better this might have been had Intel accepted that the GPU won't be used by many PC owners and used the extra space for cores and cache.

At this time there are just two socketed Broadwell desktop processors to choose from, with the cheapest Core i5 likely to cost £170. More chips are likely to appear, though what Intel won't be doing is converting all its range to 14nm at this time. Expect the low-end Pentium and Celeron labelled products to remain at 22nm, while the 14nm parts are likely to appear from Core i3 upwards.

What this part doesn't do is impinge on the high-end Haswell-E and its X99 architecture, which is still the performance nirvana for those that can afford it. The commonly held view that instead of moving this line to Broadwell-E in due course, instead it will leapfrog directly to the next architecture when the time comes.

But the major elephant crowding this product line is that as improved as the Iris Pro graphics are, I can double the gaming frame-rates it offers with a £50 Pentium G3258 and a £66 R7 260X combined. As the i7-5775C is likely to cost around £300 when it's available in the UK, those numbers just don't stack up for games or anything that's graphics not CPU dependent.

> **“As a rule a die shrink usually nets you a 5-10% performance kick, and that's almost exactly what's on offer”**

Economically, unless you have some weird aversion to inserting cards in your PC or you've got a SFF rig that can't take one, there seems little point in embracing this solution for its graphics potential. For pure computing, it doesn't beat the top Haswell processors with their 4GHz baseline clocks either.

The other blot on this gloriously sunny landscape for Intel is that going even smaller than 14nm is going to be extremely tough and probably requires a serious rethink about how processors are manufactured and the materials used.

The temptation Intel may be resisting, given that Broadwell has only just made it to the PC desktop, is to hold Skylake back, just to give it an opportunity to sell. As it's known that Skylake will need a new socket (LGA1151) and DDR4, this might be a prudent choice.

There needs to be higher baseline clocks for Broadwell very soon, or it will be seen by many as a stop-gap design in preparation for Skylake. **mm**

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Component Watch

Component Watch

Free your music of wires with these Bluetooth bargains

There are loads of Bluetooth speakers on the market, but which of them are worth buying? If you want solid sound, good compatibility and build quality that won't fall apart the first time you drop it on the floor, you have to spend a fair amount of money – and that means hunting around to get the best price at the same time. If you don't mind spending a little bit extra in return for high-quality sound output and wireless connectivity, this week's Component Watch is for you, as we look at the best stand-alone Bluetooth speakers with an RRP over £50.

Deal 1: Microlab Bluetooth Speaker H50BT
RRP: £79.99 / Deal Price: £64.78
Built from proprietary materials to deliver high-end performance and build quality at a surprisingly affordable price, Microlab's H50BT certainly looks the part, with the 2.0 system resembling hi-fi speakers more than the standard Bluetooth monobody design. Ideal for anyone more interested in wireless connectivity than portability, and NFC pairing makes it even easier to connect supported devices.
Where to get it: Scan – bit.ly/1M7D8Ya

Deal 2: Sond Audio EMBW-13Y31
RRP: £129.99 / Deal Price: £99.99
Sond Audio's 50W Bluetooth speaker system is a single-unit device which claims to offer room-filling sound in a compact package. NFC pairing is supported, and an auxiliary USB port even allows for direct connection or older devices or if your wireless just isn't co-operating – it'll even charge them while they're connected. A palm-sized remote and call-answering features mean you won't want for anything, and at £30 off the price is definitely right.
Where to get it: Ebuyer – bit.ly/1RBhkIV

Deal 3: Sony SRS-X3
RRP: £129.99 / Deal Price: £100.42
Sony describes this speaker as providing "elegant, portable sound", but all we know is that with 20W output, dual passive bass radiators and NFC connectivity, it's a device that can't help but impress. A seven-hour battery life and portable design allow you to take your music anywhere, while connectivity with the Sony Entertainment Network allows you to stream content out of the box. It even comes with a built-in microphone to allow hands-free calling. Available in various colours, but as ever, black seems to be the cheapest!
Where to get it: Bambuzo – bit.ly/1OgurtF

Deal 4: Creative Airwave HD
RRP: £149.99 / Deal Price: £104.99
An upgrade of the earlier Creative Airwave model, the Creative Airwave HD features Bluetooth pairing and one-touch NFC, allowing you to establish connections in seconds from any compatible device. A compact form factor and rechargeable battery allow you to take your speaker with you, and Creative Multipoint means you can connect two devices at the same time, so there's no need to reconnect if you use more than one device!
Where to get it: Ebuyer – bit.ly/1M7Efa4

Deal 5: Soundfreaq SFQ-06I
RRP: £199.99 / Deal Price: £149.99
The Soundfreaq SFQ-06i is a Bluetooth compatible room speaker featuring a universal device mount for phones and MP3 players with USB-cable management or a standard line-in port for devices too large to go on top. A remote control app is available on some platforms, so you can control the output from your phone or tablet. You can even buy two and use the proprietary Dual Streaming System to set them up in stereo! Absolutely tons of features worth going for.
Where to get it: Argos – bit.ly/1MKQfva

How 3D-printed rats could offer schools a vegetarian dissection

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A fresh take on technology

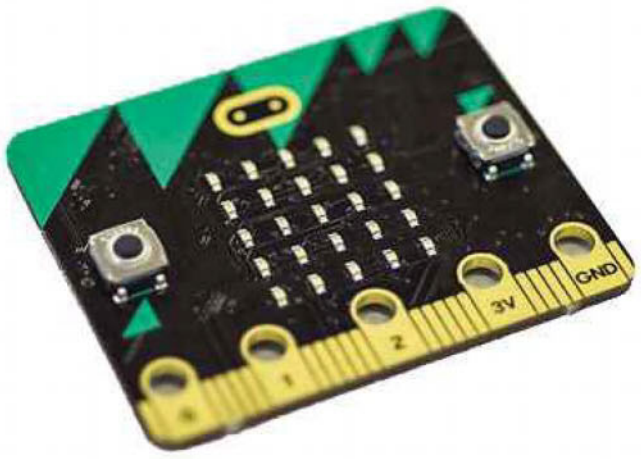
NEWS AND VIEWS

Micro Music At TNMOC

World's earliest computers make sweet sounds

Micro Bit Coming To Schools

Final design revealed by Auntie Beeb



You little beauty (apologies there, we've been listening to The Ashes). The BBC has revealed its final design of the Micro Bit computer that's going to be handed out to a million school kids in the UK.

This "groundbreaking" collaboration between no fewer than 29 partners, including ARM, Microsoft and Lancaster University, has resulted in a pocket-sized computer featuring an array of programmable 25 red LEDS, which can light up, flash messages, create games and "invent digital stories".

Among its key features are a couple of on-board programmable buttons that can pause or skip songs on a playlist, or allow the Micro Bit to be used as a games controller. An on-board motion detector detects movement such as shake, tilt and freefall (for example, the board can be used as a spirit level), while a built-in compass is there for good measure. Bluetooth connectivity and five I/O rings will connect to devices or sensors using crocodile clips or banana plugs.

Each element of the board is programmable via easy-to-use software on a dedicated website at **microbit.co.uk**, accessible via desktop or mobile devices. Encouraging children to write simple code, this represents some of the BBC's finest work.

QUICK BITS... According to the Wall Street Journal, Apple is asking suppliers to make up to 90 million units of the

The National Museum of Computing is promoting The Imitation Archive, a musical composition made at the museum using an audio archive taken from 43 machines covering the last 70 years of computing.

Created by award-winning sound artist and composer Matt Parker, the Imitation Archive now forms part of the British Library Sound and Vision Archive, as well as being lodged at TNMOC at Bletchley Park.

Including HD recordings of the rebuild of the Colossus, the Harwell Dekatron, 1970s mainframes and 1980s desktops, this is quite the geek project. The recordings themselves have been remixed, and the resulting composition was to be aired in its entirety via an Australian public broadcast at the time of writing.

Flowers, a feature track from the project is now available online at **goo.gl/Ifrn9a**. The full composition will come to **www.tnmoc.org** in time.

ViewSonic Sees The LightStream

High-def series of projectors coming in August

ViewSonic is going to launch a series of high-definition projectors called LightStream.

The PJD7 projectors promise to deliver true-to-life image projection, optional wireless and decent audio performance. Targeted at the home entertainment and hospitality markets alike, these projectors are all about best-in-class colour accuracy, with a newly designed six-segment colour wheel for any lighting condition. Brightness levels range from 3,200 to 3,500 lumens displaying in Full HD, and there's also enhanced integrated 10W or 16W sound with ViewSonic's SonicExpert technology, and prices for the projectors start at £549.

Connectivity is provided via a couple of HDMI ports and wi-fi, and there's also a USB port for powering media streaming dongles or the optional WPG-300 wireless dongle from ViewSonic, costing £129.

Head for **www.viewsonic.com** for more details come August.

Like the majority of Window users, I currently run Windows 7 on my main PC. And I also run it on an old media system I have, as well as in Boot Camp on my Macbook.

As a tech journo I felt obliged to install Windows 8 on at least one of these systems, so the media system hosted that OS for a while – until I actually wanted to use it for more than five minutes, when it proved too frustrating for me, and I ended up putting Windows 7 back on again.

Now Windows 10 is upon us and, wisely, Microsoft has made it free, because most people probably wouldn't upgrade from 7 otherwise. I know I wouldn't.

When 10 does arrive, I'll be making the media PC the guinea pig again. I'm not ruling out upgrading my main system as well, but Windows 10 is going to have to be something special to convince me.

What about you? Will you be upgrading when the time comes?

Until next time,

Anthony

Editor

Meanwhile... On The Internet...

Reddit's recent problems began with the dismissal of popular staffer Victoria Taylor, a move that caused a revolt among volunteer staff and eventually led to the resignation of interim CEO Ellen Pao (**tinyurl.com/MMnet72a**). But they appear to be far from over. Not only have they created a barrage of think-pieces questioning the validity of its business model (**tinyurl.com/MMnet72b**), they've bought to the surface problems behind the scenes of the company.

A post on the site by Yishan Wong – another former Reddit CEO, who resigned from the company last year – claims that the site's co-founder, Alexis Ohanian went over Pao's head to sack Taylor and then let her take the heat for it from the community by not admitting as much (**tinyurl.com/MMnet72c**). Wong later went on to dish up some interesting information regarding the criticism that Pao took for allegedly wanting to cull certain unsavoury parts of the site and clean up content. Contrary to the line many users of the site took in asserting Pao wanted to limit free speech (**tinyurl.com/MMnet72d**), he asserts Pao defended keeping the subreddits alive (**tinyurl.com/MMnet72e**) in the face of pressure from others – not least Ohanian.

Indeed, in saying that Reddit was never designed as a "bastion of free speech" (**tinyurl.com/MMnet72f**) in a recent AMA, the site's other founder Steve Huffman – who's been bought back into the fold in the wake of Pao's departure – somewhat backs up Ohanian's assertions as to the founders' beliefs. What's more, it appears that the company will now be adopting what he insists was Pao's preferred option of allowing but burying controversial content on the site (**tinyurl.com/MMnet72g**).

Will Reddit's new content policy be enough to shut down the recent controversy? Well, if comments by another high-profile female member of staff who has decided to leave the company (chief engineer, Bethany Blount) are anything to go by, probably not (**tinyurl.com/MMnet72h**). Her assertion on the matter does not bode well: "there are some very aggressive implied promises being made to the community – in comments to mods, quotes from board members – and they're going have some pretty big challenges in meeting those implied promises."

Regular readers will no doubt remember the now-infamous Spamhaus DDoS of 2013. It was an attack that upped the ante on such online vandalism (**tinyurl.com/MMnet72i**) by using a technique called DNS Reflection (**tinyurl.com/MMnet72j**). And if you believed the somewhat-sensational headlines, mainly instigated by a blogpost from Cloudflare (**tinyurl.com/MMnet72k**), it came close to bringing the internet as a whole to its knees (**tinyurl.com/MMnet72l**). However, perhaps most shocking was the fact that it appeared to largely be the work of a London-based 16-year-old.

Some two-and-a-bit years later, that teen, Seth Nolan-Mcdonagh (aka Narko), who had apparently been hacking for money as part of an online collective since the age of 13, has been spared jail despite pleading guilty to the crime. Apparently, the judge took into account extenuating metal health issues that were affecting him at the time, as well as his "complete and genuine remorse" over what he had done (**tinyurl.com/MMnet72m**).

Judge Jeffrey Pegden was quick to point out that only the exceptional personal circumstances and his "remarkable" rehabilitation had kept Nolan-Mcdonagh out of prison, saying that the "persistent distributed denial-of-service attack was so sophisticated and unprecedented in scope [it] had a worldwide effect" and that "these crimes were and are serious."

For its part, a Spamhaus spokesmen said that it fully appreciated the "difficult predicament with which the sentencing judge was faced, and hoped that anyone considering similar attacks will take heed of his remarks that in any other circumstances such criminality would have resulted in a custodial sentence" (**tinyurl.com/MMnet72n**).

You may not be aware of Dubsmash (**www.dubsmash.com**), the app that allows you to create perfectly social media-sized lip-sync vids, but you may have heard of Marvel's *Agents Of Shield* and *Agent Carter*. Well, the cast of the two shows used the popular app to take part n an increasingly entertaining game of oneupmanship last week – a so-called Dubsmash War – which played out across the Twitter accounts of stars Hayley Atwell (**tinyurl.com/MMnet72o**), Clark Gregg (**tinyurl.com/MMnet72p**) and Chloe Bennet (**tinyurl.com/MMnet72q**). As we go to press, there appears to be a cessation in hostilities, after Atwell called in Captain America to force a surrender (**tinyurl.com/MMnet72r**), but it's a tinderbox that threatens to ignite again at any moment. We hope it does.

Just in case you were under the impression that Chris Pratt wasn't the coolest dude on the planet, we'd like to point you in the direction of his Instagram account (**tinyurl.com/MMnet72s**). It documents some of the press tour he's been undertaking for *Jurassic World* and also features a series of photos of his character's Lego likeness that he's been taking around the world with him.

Lego Owen has so far been pictured (either on his Lego bike or with Lego raptor squad) in London, Germany and Japan, making us all insanely jealous that a) we aren't in those places, and that b) we don't have a Legogänger to keep us company... Sob.

.AVWhy?

Videos For Your Eyes... Not Necessarily For Your Brain

The untimely passing of Nintendo president Satoru Iwata shocked the gaming community and brought forth many touching tributes; they came in the form of words from friends (**tinyurl.com/MMnet72t**) and fans (**tinyurl.com/MMnet72u, tinyurl.com/MMnet72v**), music (tinyurl.com/MMnet72w) and pictures (**tinyurl.com/MMnet72x**). Perhaps, though, it's best to remember why people respected and liked him so much – because, in his own words, he had the "heart of a gamer" (**tinyurl.com/MMnet72z**).

QUICK BITS... Facebook has changed its Friends icon, with the female icon now up front

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Caption Competition

What are this young couple so happy about, we wonder. Don't they know it's been raining this week? Anyway, captions time…

- **doctoryorkie:** "With Apple users the glass is always half full. With non Apple users it's just a glass."
- **pesukarhu:** "Cool, it's got a 3D touchpad!"
- **Mad Malc is back:** "The 'Any Key' is over there!"
- **Thomas Turnbull:** "Liquid cooling just got a whole lot better."
- **Greg Lester:** "Hipsters see themselves in Skype and finally realise what everyone is laughing about."
- **Greg Lester:** "We're on TV! Oh, no, hold on… it's just Skype."
- **James Frasier:** "It's not an Apple Mac, it's a Maccle App. You won't have heard of it."
- **Ryan Copely:** "Happy hipsters planning what to wear spontaneously tomorrow."
- **Robert Standing:** "Us, pretentious? No way. We're just casually enjoying this four-hour documentary about the social significance of basket weaving in Angola during the 18th century. Totes amazeballs."
- **Duncan Fogarty:** "Ha, ha. This thing is made by a company the 'norms' have heard of!"

Many thanks to everyone for those, and congratulations to pesukarhu for "Pull my finger...." That never gets old. At least that's we keep telling ourselves anyway…

To enter this week, head to the 'Other Stuff' section of our forum (**forum.micromart.co.uk**) and say something funny (but not too rude) about the picture below or email us via **caption@micromart.co.uk**.

Microsoft Sheds Jobs

Nearly 8,000 more to go

The job losses just keep on coming at Microsoft as the company has announced a reorganisation of the Nokia mobile unit.

Having already decided to shed a mighty 18,000 positions last year, largely from the Nokia unit, this latest line of 7,800 losses will combine with a writedown on the value of the unit to the tune of $7.6bn.

That writedown is worth particular attention as it pretty much wipes out the cost of the original acquisition of the Nokia business. Satya Nadella, it seems, has decided to undo what Steve Ballmer did on Nokia – and it's taken him under two years to do it!

Microsoft

Xbox Music Gets New Groove

Rebrand for digital streaming service

In a slice of news that may have passed you by, Microsoft has renamed its Xbox Music service Groove.

Why Groove? "Groove describes what people feel and do with music." Urgh. Why not Xbox Music? Well, according to Microsoft's Joe Belfiore's Twitter stream, there was confusion abound. "Lots of people were saying "I don't have an Xbox, why would I use Xbox Music?""

Of course, now people will be forced to tell people that they're using Groove, which is quite a dreadful brand name if you ask us. Not very Groove-y.

'With moments of real genius, some of his poems will last as long as poetry is read.'

– Benjamin Zephaniah

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Felix Dennis

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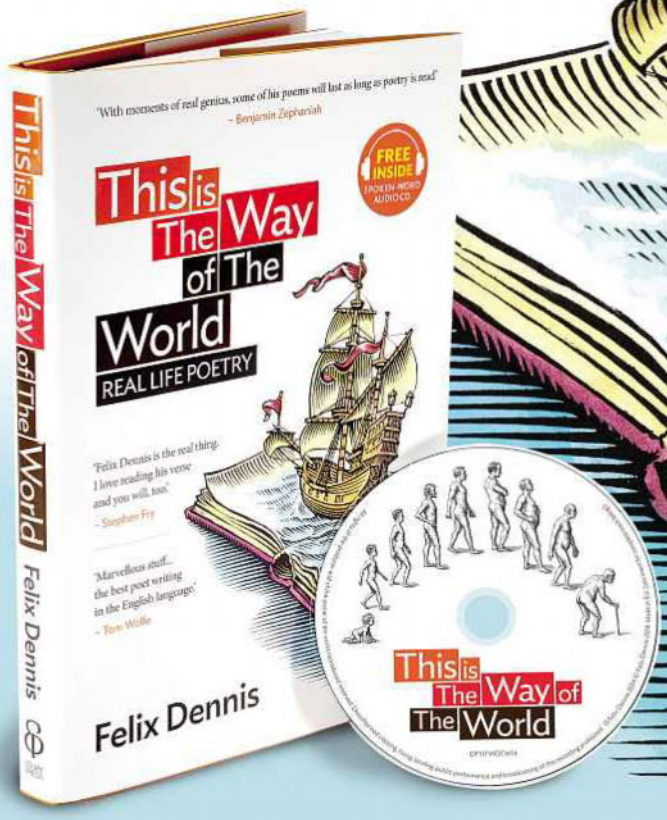


A book of poems for those who don't read poetry (as well as for those who do!)

A collection of 'real life' poems by Felix Dennis, one of Britain's best-loved poets, charting life's course from infant to endings with illustrations by Bill Sanderson.

www.felixdennis.com contains many poems, published and unpublished, as well as a library of sound recordings and video footage of Felix Dennis's verse and poetry tours.

EBURY PRESS

Snippets!

Project CARS Kid Crowned Champ

Congratulations to ten-year-old Jack Hillery who has been crowned champion designer of the CAR of the future for Bandai Namco's *Project CARS*.

The nationwide competition asked players to design a racing CAR of the future and of the 8,000 entries, young Hillery won out. For his efforts, the youngster met a professional racing driver and was handed a framed picture of his design, a certificate and a PS4 console.

Woah! IBM Makes 7nm Breakthrough

Those clever chaps at IBM Research have announced a big development in chip manufacturing: they've only gone and developed the first working microchip on a 7nm process.

The key headline here is that IBM thinks that this development will bring about a possible 50% increase in processing speeds when it's turned into commercial use some years down the line.

This hasn't happened by chance. This is a joint project with GlobalFoundries, Samsung and others, and it's part of a $3bn spend into R&D in chips over the past five years-plus.

Ada Competition From TNMOC

Forgive us for the second news report from The National Museum of Computing, but this contest is worth a mention.

Female students up to 18 years old are being asked to enter this competition that marks the 200th anniversary of the birth of Ada Lovelace. Run by the museum and the University of Oxford, the contest is asking what entrants would like to communicate to Lovelace about 21st century technology, the overall idea being to inspire more female students to take up computing.

Full details of the competition are at the microsite **www.tnmoc.org/ada**.

Cougar Pro Mouse Roars Into View

Programmable buttons, ergonomic design

Gamers, pay attention: there's a new mouse in town.

The Cougar 300M professional-level gaming mouse looks the part with its striking, powerful appearance, and it has the features to back it up. A 4000dpi sensor provides reliable and accurate control, for both professional and casual gamers alike. Its 1000Hz polling rate ensures fast reaction times, and it has a good lifespan of at least five million clicks.

Housing seven fully programmable and ergonomically located buttons, this has been designed to make them easily accessible while preventing accidental or erroneous clicks. The on-board memory allows for three full configuration profiles, and the 16.8m colour LED backlight allows for easy identification of what profile you're using, while also enabling customisation of its appearance. Finally, a soft-touch surface means it's comfortable.

If you fancy this one head for **www.overclockers.co.uk**.

YouTube Star Earns Millions

$7 million, to be precise

You may or may not have heard of PewDiePie (not his real name – that would be Felix Kjellberg). Well, whether you've heard of him or not, this Swedish purveyor of Let's Play gaming videos is the man behind YouTube's most popular channel with 37 million followers.

He is also a multi-millionaire, earning around £4.5m last year, with news of his financial wellbeing coming from a Swedish news site, Expressen. The 25-year-old is clearly highly appealing to YouTube's key demographic – that of young adults and teenagers. Posting videos online probably seems like a walk in the park to many of us, but bear in mind that the numbers watching his videos are just astronomical, and in many respects Kjellberg is proof of the changing media habits of the current generation. We've come a long way from just four channels to choose from, people.

He has reacted with anger to people questioning his riches, saying in a video (posted on his channel, obviously) that there is "much more" to what he does than simply sitting and shouting at the screen. He's quite the charity man, by all accounts.

Anyway, an analyst was quoted on the BBC's coverage of this story as warning not to expect such financial gains yourself if you decide to go down this road. There are many YouTubers out there who are not making any cash whatsoever.

Perhaps PewDiePie could lend them a bob or two...

QUICK BITS... **YouTube now has 240 billion views a month, according to media reports citing**

Get A Desk In A Tap

App encourages remote working

New app alert, and this one's potentially pretty useful for any remote workers among you looking for a desk to work at at short notice.

NearDesk is a service that lets you rent desk space and only pay for the time that you use, and it's now launched its own app to make an immediate search of the area for the nearest desk when you're out and about. If you've ever worked on a laptop in a noisy coffee shop, then this could provide a cracking solution for you.

Allowing users to tap in and tap out of workspaces and charging them by the hour, this takes in around 200 locations across the country, so you're not tied to one place. Dead time between meetings? This could be the answer.

With descriptions of the hubs, prices, opening times and an option to call ahead, charges start at a few pounds an hour. This is available as a free download on Android and iPhone. You know where to go.

Finland Youth Guilty Of Cybercrimes

Over 50,000 crimes, to be exact

When we were teenagers, the order of the day was something along the lines of playing cricket in the streets with our mates and playing many a game of *Match Day II* and *Strider* indoors.

Not so for Julius Kivimaki. Kivimaki, it seems, has been something of a naughty boy. He's been found guilty in the country of over 50,000 "instances of aggravated computer break-ins" according to the BBC. Other reports have suggested that his involvement with the Lizard Squad has linked him with the attacks on the PSN and Xbox Live services last year, and he sounds like a busy chap, hijacking emails, blocking web traffic and thieving credit card details.

As he's still a teenager, and he was between 15 and 16 years old at the time of his nefarious activity, he's not going to face prison time. Instead he's been handed a two-year suspended sentence, as well as having his PC taken off him.

Say it with us, people: crime does not pay.

Time Warner Cable In Big Trouble

Harassment case results in big fine

Anyone reading this next story who find so-called 'robocalls' a bit distasteful can afford themselves a little smile.

The case of Araceli King versus Time Warner Cable was such a serious one that the telecoms firm was accused of placing 153 automated calls to King's mobile phone during the course of a year. The calls were actually not meant for her at all but were in fact for someone who used to have her mobile number. Despite King making that critical fact very plain during a call to one of the company's customer reps, the automated robocalls just kept on coming.

The case went to court, and Time Warner Cable was ultimately fined $1,500 per call in damages for breaching the Telephone Consumer Protection Act, intended to combat such phone call abuse. 153 multiplied by $1,500 equals an eventual damages payout of $229,500. With just less than half of these calls coming after King initially sued over this case in March last year, this has proven to be an expensive legal matter for the telecoms company.

Archos Weather Station

David Hayward has a go at predicting when it's going to rain

DETAILS
- **Price: ~£100**
- **Manufacturer: Archos**
- **Website: goo.gl/jQ0PAe**
- **Requirements: Android version 4.0 or later, iOS version 6.0 or later**

The Archos Weather Station, with indoor and outdoor orbs and the soil probe

The app is simplistic enough, but valuable environmental data can be had from it

As Mrs Dashwood in *Sense and Sensibility* once said, "If you cannot think of anything appropriate to say, you will please restrict your remarks to the weather", which demonstrates the British fascination of the weather past, present and future.

It's obviously something we take considerable time over. There are umpteen weather apps installed on our phones and desktop, as well as reports every half-hour on the radio. Perhaps it's not just a British thing? Maybe it's a human thing?

To help satisfy our odd addiction to the weather, Archos has introduced a smart weather station that works with an accompanying Android and iOS app.

The Weather Station consists of three main elements: an outdoor sensor, indoor sensor and a soil module. Both the indoor and outdoor sensors are a pair of spheres with white plastic upper hemispheres and a polished aluminium lower hemisphere. The soil module is a long probe-like device with a rounded top, where the sensor and electronics are housed along with the battery compartment.

It's quite an impressive, futuristic-looking setup and thankfully remarkably easy to use. All you need to do is download the Archos Weather Station app from the relative store (or by scanning the appropriate QR code on the box), power up the indoor orb followed by the outdoor orb and the soil module and locate the kit via wi-fi on your phone.

When you've registered the kit with the Archos app, you can then go through the motions of pairing everything, which each module will enter when you insert the batteries. The indoor orb connects to the app through its built-in wi-fi connection, then it communicates to the outdoor module and soil module via an RF connection, which is good for at least 100m (30m for the soil module).

The data available from the indoor orb is quite interesting, covering temperature ranges from -5°C through to 50°C, humidity from -1% to 99%, atmospheric pressure from 850hPA to 1050hPA, CO2 levels from 0ppm to 5000ppm and a noise sensor that measures from 35dbA to 110dA.

The outdoor orb measures the temperature from -50°C to 70°C and humidity from -1% to 99%, while the soil module reports soil temperatures from -50°C to 70°C and humidity from -1% to 99%. Sadly, there's no rainfall monitor or wind speed indicator available for the outdoor kit.

The information display on the app is well ordered and split into four sections detailing a three-day forecast, the indoor measurements, outdoor measurements and the state of the soil. You can opt to view more detailed information on the current views, as well as setting up alerts altering the station configuration and changing your preferences.

Over time, the data can be viewed in a variety of graphs, so you can monitor the improvement of air quality inside different parts of the home, for example, or the quality of the soil if you're planning on planting something more exotic than our climate can normally handle in the greenhouse. There's not a huge amount of data involved, but it does have its uses.

The Archos Weather Station is a fun kit to have. There are real-world uses for it, as well as the scientific fascination involved with changing environmental units. It's fun, basically. However, at around £100, it is a little pricey.

mm David Hayward

Fun and interesting

XFX Pro 850W Black Edition

Mark feels the power flow from XFX to dedicated gamers

DETAILS
- Price: £106.62 (Scan)
- Manufacturer: XFX
- Website: xfxforce.com/en-gb/home
- Requirements: ATX v2.2 system
- Part No: P1-850B-BEFX

There was a time when those who bought power supplies just wanted more watts and maybe some dedicated PCIe lines for that demanding video card. But things have drastically changed, and the power demands made by the PC are actually going down.

In that respect, the XFX Pro 850W Black Edition might look rather over-specified in a couple more years, once 14nm and smaller technology filters into the mainstream.

But for those with multiple GPUs or banks of hard drives already installed, something this efficient, well made and engineered should be highly desirable.

XFX previously made a 'Black Edition' 80 Plus Bronze supply that was partially modular, but this design has 80 Plus Gold certification and complete cable modularity.

Therefore even the big ATX24 cables detach, though without it the PC can't demand power from the PSU, so leaving it off entirely isn't a real option.

In most PSU ranges 850 watts is near the top of the range, but here XFX makes a 750W little brother and two 1050W and 1250W bigger siblings. All of them are rebranded Seasonic X-Series designs, and XFX has followed Corsair in its reuse of this very solid design.

Without any cables initially attached, the Pro 850W makes for a very easy install in most cases, as it's just 160mm long front to back, 150mm deep and 85mm high. The underside is dominated by a 120mm fan, the speed of which is controlled by internal sensors.

One of the immediately attractive features is a small switch that allows 'normal' or 'hybrid' fan mode, the latter of which reduces fan speed and by definition system noise.

In terms of power delivery, 850 watts gives you a predictably large selection, given that once ATX12V/EPS12V are accounted for there are ten connectors to be divided up between SATA (10), PCIe (6 x 6+2 pin), Molex (5) and a single floppy power source.

The breakdown of power is pretty straightforward, with 3.3V and +5V each getting a maximum of 25A, and the +12V rail getting a massive 70A to play with. Obviously if these all demanded the maximum level it would exceed the power budget, but the 'EasyRail Plus' architecture does avoid having unavailable amps stashed away.

Those wanting to build a multi-GPU rig need to consider just how much each card will draw, because there are cards like the monster GTX Titan Z that pull 42A, and you'd really only want one of those on this PSU.

Conversely, as they only draw 20A, three GTX 960s might well be fine. However, I'd recommend that anyone getting close to exceeding the limit should move up to the next wattage rung and give themselves plenty of extra head room.

As supplies go, the XFX Pro 850w Black Edition is a classy act with a strong pedigree and a five-year warranty. And I'd contest if you treat it right, it should be working long after that.

mm Mark Pickavance

Model: P1-850B-BEFX					
DC Output	+3.3V	+5V	+12V	-12V	+5Vsb
Max Output	25A	25A	70A	0.5A	3A
Max Combined	125W		840W	6W	15W
Total Power	850W				

Great-quality PSU with enough amps for most people

BenQ XL2730Z Monitor

The only gaming monitor you'll ever need?

DETAILS
- Price: ~£340
- Manufacturer: BenQ
- Website: goo.gl/hfdwjM
- Requirements: AMD Radeon cards for full FreeSync compatibility

Not only is the BenQ XL2730Z a great quality monitor, it also has loads of features

It's not just gamer who will benefit here: the ergonomics of the XL2730Z are excellent

A little while ago we reviewed the excellent BenQ XL2430T, a gaming monitor that seemed to have pretty much everything you could ever hope for. Now BenQ has continued to extend its XL range with the XL2730Z.

This LED 27" TN panel follows the same raw gaming specification as the previously reviewed XL model, and the rest of the gaming standards on the XL range. It's a professionally designed gaming screen that's capable of a maximum resolution of 2560 x 1440, at 144Hz and offering an excellent 1ms response time.

There's support for FreeSync AMD Radeon cards, to eliminate screen tearing, BenQ's own motion blur reduction technology and 20-level colour vibrancy settings. You'll also find the highly acclaimed BenQ eQualiser technology, which brightens dark areas of a game without overexposing the surrounding brighter areas. It's a technology that has so far proved very effective, especially in team or deathmatch-based games, and it works just as well on consoles as it does on the PC.

Again, as with the other XL range, the 2730Z is an well-designed monitor in terms of ergonomics. There's a fully adjustable height stand, with measured red-coloured scale indicator for 24 settings, along with a scale for the screen tilt and swivel. It's a commendable addition and something that's sadly missing from many monitors, let alone gaming specific models.

Finally, the XL2730Z features a wired remote puck-shaped control that will bring up the on-screen menu, with five buttons surrounding a scrolling wheel. It even has an indented docking space built into the monitor stand. Furthermore, there's a pull-out headphone hook, a carry handle at the top of the stand and a large hole at the bottom of the stand to keep those annoying cables as tidy as possible.

The XL2730Z's connectivity is superb, offering a pair of HDMI ports, a single DVI, DisplayPort and VGA. There's a mini-USB port for the remote to plug into and a further USB type-B input for the side accessed, two port USB 3.0 hub (just below the headphone retractable hook).

The screen quality is very good, certainly more than enough for the dedicated gamer. Admittedly, though, the viewing angles aren't quite as good as a monitor with an IPS screen, since this is a TN panel. However, once you angle the monitor to your particular preference, the image displayed is colourful, vibrant and when used in conjunction with the eQualiser technology, really brings out the superb visuals in any game, photo or video.

Sadly we didn't have an AMD graphics card installed to test the FreeSync feature, so we can't really comment on how effective it actually is. It seems a bit of a gamble to take, though, on the part of BenQ, to opt for an AMD supported feature instead of the rival Nvidia G-Sync. We imagine this is due to the PS4 and Xbox One both using AMD graphics technology, but it is rather limiting. Could both technologies exist side by side, catering for all hardware setups?

Regardless of our lack of FreeSync abilities, the BenQ XL2730Z is an excellent gaming and everyday use monitor. The ergonomics alone are worth every penny, but when combined with the screen quality and features, this is certainly one monitor to consider for your next upgrade.

mm David Hayward

A superb gaming monitor

Edifier Studio M3280BT Speakers

A new set of mid-priced powered speakers from Edifier

DETAILS
- **Price: £ 79.99**
- **Manufacturer: Edifier**
- **Website: goo.gl/KnKsYy**
- **Requirements: Bluetooth device, or a sound source via a 3.5 stereo jack or 2 RCA jacks**

The connections are on the rear of the speaker

I think it's fair to say that these days most of the population carry mobile phones. It's also a fair assumption that the vast majority of these are so called 'smartphones', which means they incorporate things like a GPS, camera, media player and much more. They also have multi connectivity, including wi-fi and of course Bluetooth. That coupled with the fact that most users carry around their music collection makes them ideal as portable music centres. Their only failing is the quality of the tiny speaker on board, which is why you'll see most users walking around with earphones perched on or in their ears.

Clearly this has disadvantages when you're at home or work, when headphones would be restrictive. The alternative to this would be a set of external speakers, and to save the tangle of cables, ideally they would also be Bluetooth.

As I'm sure you know, these come in all shapes, sizes and prices. One of the biggest manufactures of these is Edifier, and over the past few years I've reviewed many different sets from this company, varying from those designed simply to add sound to your PC, which tend to be cheap and cheerful, to those like this latest release, which is quite a step up from any I've seen before.

The new Edifier Studio M3280BT speakers consist of two relatively small satellite speakers measuring 124mm x 255m x 125mm, and a large subwoofer measuring 235mm x 244mm x 293mm. They are quite nicely styled, with a matt-black finish. The satellite units are tall, slim enclosures that connect to the bass box with an RCA plug, and unusually a DB15 VGA type plug as well, although once I had the system set up it became obvious why they'd used it. The left hand speaker has the controls for the volume, bass, and treble, and it also includes a headphone jack. Quite a sensible arrangement, I feel, because the bass unit usually sits on the floor, so you wouldn't want to be crawling around the floor just to make any adjustments. In the case of the M3280BT, the woofer only has an on/off switch for the power.

Connecting to the speakers via Bluetooth is simplicity itself and just matter of scanning from your device until you find the Edifier M3280BT. No password to connect was required and it has a range of 10 metres. If you're using the speakers with a PC or another media device, you can alternatively connect using the supplied RCA cables. These plug into the woofer, which has dedicated PC and aux inputs.

As far as the sound quality is concerned, given the price, they're simply superb. The treble tones are bright and clear, and the woofer adds that element of bass depth needed for an all-encompassing sound. As you can tell, I was pleasantly surprised and very impressed by these speakers. They compare favorably with speakers costing twice as much, (if not more). When used with an MP3 player or a mobile phone, they could easily replace a traditional home media centre.

mm Joe Lavery

Superb quality sound
Highly recommended

Doro Liberto 820 Mini

Mr Fereday puts his age to good use as he checks out a Doro smartphone

DETAILS
- Price: £108.99
- Manufacturer: Doro
- Website: www.doro.com
- Requirements: n.a.

Arriving with the tagline of 'Small size, big heart', the Doro Liberto 820 Mini is a smartphone that has been designed to buck the trend of 'big is best'. This handset is primarily aimed at those of mature years looking to make their first venture into the world of smartphones.

Available in a choice of silver, white or red, the Liberto 820 Mini has dimensions of 126 x 66 x 11mm and weighs 132g (battery included). Dominating the front of the unit is a 4" colour touch screen with a 52 x 87mm display area delivering a resolution of 800 x 480 pixels. You can adjust the brightness and contrast plus opt for a large text display in the event the user has limited visual facilities.

Arranged beneath the screen are the three standard Android buttons for back, home and menu. It's important to note that these buttons are not touch sensitive. They do need a degree of pressure before their functionality is activated.

Positioned on the left side of the handset are power and volume level controls. On the opposite side is a camera shutter button plus a micro-USB port for charging the handset's battery. Charging can be carried out directly through this port or via the bundled docking station connected to a power source using the supplied standard-to-micro USB lead.

With the handset mounted on the docking station in landscape orientation, this arrangement can act as a clock with changing background images. A socket for headset use is located on the top of the handset.

The Liberto 820 Mini features both front and rear mounted cameras. The 5MP rear camera has its own flash unit and gives you a choice of predefined settings for various scene types. Captured image quality is of a reasonable level with either camera.

The back of this smartphone can be removed by running a thumbnail around it, starting at a small indentation in the lower left corner. The revealed compartment houses the 1500mAh Li-ion battery pack, SIM card and an optional micro-SD card to supplement the default offering of 4GB. Around 40% of the supplied storage will have been commandeered by the Android 4.2.2 operating system and preinstalled apps.

The Doro start-up guide leads you through the steps to get this handset up and running. You can select the language, integrate the handset into a wi-fi setup for internet access and create a Google account, which is fairly standard fare. However, Doro also offers the choice of 2 x 3 or 3 x 4 layouts for the large icons used by apps with this handset.

While the actual appearance of the home screen is pure Doro, the selection of preinstalled apps leans more heavily on easily recognisable Android offerings. The initial home page provides phone, messages and camera quick links, with slots to add three of your own favourites. You also get buttons to access Google apps and the 27 apps that Doro has preinstalled on this handset.

Included among the latter category is the My Doro Manager. This feature allows Helpers, such as friends or family members, to provide remote assistance when required. The handset also supports ICE (In Case of Emergence), and there's an Assistance Button on the rear of the unit to call for help from a special list of contacts. This feature is turned off by default.

mm **Michael Fereday**

A handy-sized phone for those putting functionality before fashion

EDITOR'S CHOICE micro mart

MSI Cubi

It may be small, but there's a lot going on in this tiny PC

DETAILS
- **Price: From £99 barebones**
- **Manufacturer: MSI**
- **Website: goo.gl/GLxTtn**
- **Requirements: mSATA drive, RAM, Windows 8.1**

In black or white, the MSI Cubi is a great-looking mini PC

There's ample connectivity and tons of potential

The design is great, and it's whisper quiet too

The reign of the tiny but amazingly powered PC is upon us. We've already seen a collection of small footprint PCs come through our doors with the likes of the Gigabyte Brix, and we've been singularly impressed with each and every one – especially the performance on offer from such small computers.

The MSI Cubi, though, could be the one that takes the top prize, in terms of a combination of performance, design, specifications and price.

The Cubi is remarkably small, measuring just 115 x 111 x 35mm and weighing a mere 295g. It's available in both white and black plastic models. It's square with rounded corners, except for one corner where the power button is located, which angles down slightly and displays an LED glowing power symbol, with is rather reminiscent of the older AcerRevo R3610.

As with most mini-PCs on offer, the MSI Cubi comes in a number of specifications. There's an Intel Celeron-3205U version, with 2GB of DDR3L 1600MHz RAM and a 64GB mSATA drive with Windows 8.1 installed; a Pentium-3805U version with the same 2GB of memory but a 128GB mSATA drive installed; and finally an Intel Core i3-5005U, with 4GB RAM and a 128GB mSATA, which we're currently reviewing in this instance. There's also an i5 version available soon, but we don't have the full specification of that model yet.

Each version has an extra slot for a 2.5" drive, which comes in the form of an optional back vented case with support struts and a SATA cable, gigabit Ethernet, 802.11 AC wi-fi, Bluetooth, two front USB 3.0 ports and two at the rear, M.2, HDMI and mini DisplayPort.

The performance of the i3 version of the Cubi is really very good. The installed copy of Windows 8.1 certainly flies through it processes, booting within seconds, providing a stable foundation for whatever tasks you'll put this tiny machine to. The 3DMark 11 score isn't the highest we've ever come across, though. At just 1010, it's hardly going to set the gaming world alight, but there's enough power there to play a selection of lighter games or older titles.

Thanks to the Intel HD5500 graphics, though, you'll be able to view HD and even 4K content without too much hassle, making this an ideal home media centre or an emulation gaming system.

It's also an incredibly quiet system. We measured the output, roughly a metre away from the unit, at just 18dbA. Once you've got it connected and in place under the TV, we suspect you'll never notice it unless you put your ear directly on the case.

Also, after running the Cubi for a good few hours and putting it through its paces, we were glad to see that it didn't have the usual small PC problem of an overheated case. In fact, it was barely warm to the touch.

While the Cubi may not be the most powerful mini PC we've seen so far, it's not far off. However, the cost of the barebones units far outweighs the slight loss in performance: the Celeron version is priced up as £99, Pentium version £129, i3 version £189 and the 95 version at £249. Once you factor in an mSATA SSD and memory, it doesn't add up to a huge expense.

The MSI Cubi is a great mini PC and one of the best we've tested in recent months.

mm David Hayward

Small, versatile and quite powerful

micro mart
Quality 9
Value 8
Overall 9

Xebec Tech Samurai

We cross swords with a capable gaming mouse

DETAILS
- **Price: £11.99**
- **Manufacturer: Xebec Tech**
- **Website: goo.gl/VTw9od**
- **Requirements: Windows XP or later, Mac OS X, optical drive for CD-based drivers and control**

The Xebec Tech Samurai is a wide mouse

It's cheap but certainly not nasty

We often get quite excited when a new gaming device or peripheral flops through our letterbox and onto the Micro Mart shagpile. It's a sad fact, true enough, but it's the little things that we enjoy so much.

The Xebec Tech Samurai gaming mouse is one such device. This eight-buttoned mouse has a lot going for it, such as the 3200dpi Avago 5050 optical sensor with adjustable dpi settings from 80o, 1600, 2400 and 3200. There's also a dedicated turbo fire button, a multi-coloured LED setup, rubberised palm and side grip finish, and a set of built-in balancing weights that make the mouse a hefty 300g.

Build quality is surprisingly good for a mouse from a company we've never heard of before. We like the wide grip and the splayed sides that offer a rest for the thumb and ring finger, with the two forward and back buttons located slightly higher but still within easy reach of the thumb.

The wide grip, though, does mean that the position of the Turbo Fire button is a slight stretch for the index finger, it being placed just to the left and raised slightly off the left-mouse button. It's not a huge issue, but if you're using it a lot with the right-mouse button then you'll start to notice a strain.

We've mentioned in the past that a good mouse depends on how it feels in the user's hand, and how it performs not just in gaming but also for normal desktop duties. Thankfully, in this case, the Samurai has a good feel to it, not too heavy and well-balanced; plus the adjustable dpi settings help to tweak the speed of the mouse to your personal tastes relatively quickly. In addition to the hardware side of tweaking, the included mini-CD contains the Samurai control centre, which enhances the functionality of the mouse by allowing you to create custom mappings for each of the buttons across four different profiles.

Along with the button customisation, you can also change the colour of the LEDs and how they're displayed on the mouse, such as pulsating or static and so on. It's a minor tweak, but one that a lot of users take pride in when matching LED colours with other kit they own.

The Xebec Tech Samurai is a reasonably good gaming mouse. It's fast, responsive and accurate, while being comfortable enough for gaming sessions, as well as everyday use for longer periods. However, the best feature here is the price.

> **"At just £11.99, this is a great buy for gamers on a tight budget"**

At just £11.99, this is a great buy for gamers on a tight budget, or anyone else who doesn't fancy spending over £30 for a gaming mouse. The Samurai proves that you don't necessarily need to remortgage your house for a decent gaming peripheral.

The wide design can be a bit too awkward for smaller hands, admittedly, but for an adult/young adult it shouldn't be a problem. In conclusion, we think the Xebec Tech Samurai gaming mouse is a great choice for those looking to spend very little on their next mouse.

mm David Hayward

A wide grip mouse, with plenty of features and at a good price

Zortam MP3 Media Studio 19.35

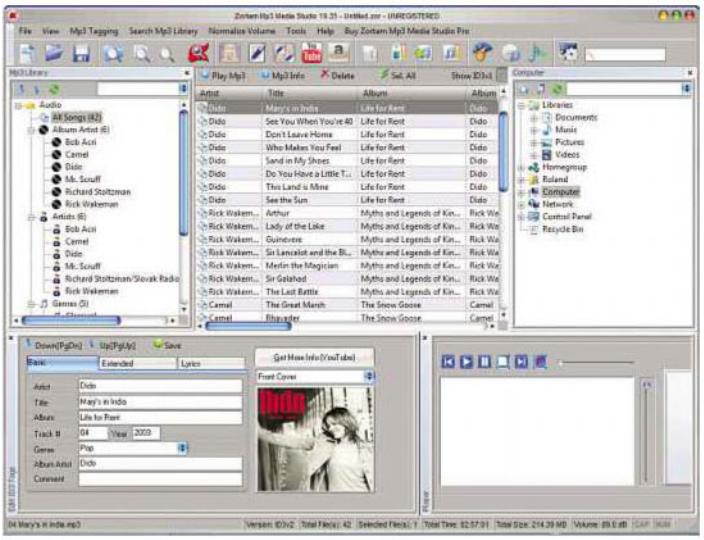
Rip CDs, import MP3s and organise your music with this inexpensive music studio

DETAILS
- **Price: £16.93**
- **Manufacturer: Zortam**
- **Website: www.zortam.com**
- **Requirements: Windows XP or later, 1GB RAM, 1GHz processor, 70MB disk space**

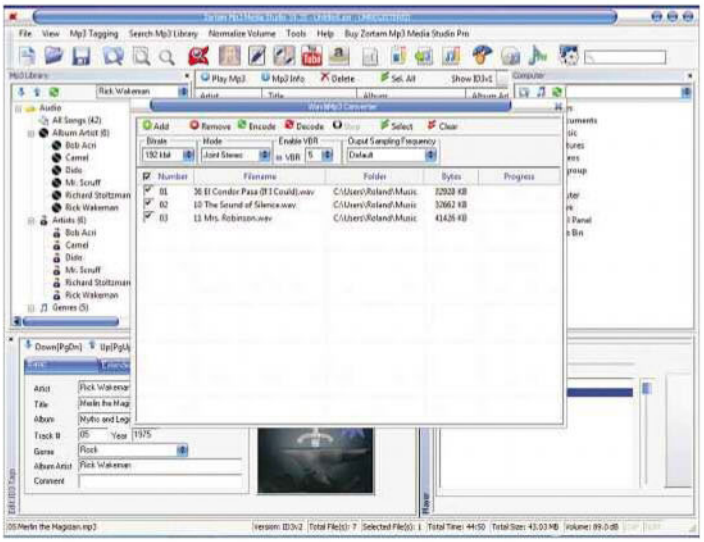
Streaming music services like Microsoft Groove, Apple Music, Google Play Music and others might be liked by some people, but not everyone wants to pay a monthly subscription to listen to music. You could use Windows Media Player or iTunes to play music on the PC, but beyond those two programs, what else is there? Zortam MP3 Media Studio is an alternative that is worth considering.

This is a cheap music player, organiser and toolkit all rolled into one and it has some useful features. For instance, when it is first run, it scans the disk drive for MP3 files and loads the details into its library. If you add more music to the computer, you can add tracks and whole folders. CDs you own can be ripped to MP3 and the tracks added to the library. A range of bitrates is available from 128 to 320Kbps and while ripping a CD, Zortam will retrieve relevant information from the internet like track names, album artwork, lyrics and so on. It can rip to WAV files and convert WAV to MP3 too.

There's a library panel that enables you to view all tracks, or to filter them by selecting an artist, genre, album, year.



The interface is busy, but you can hide the panels you don't need and skin it



Rip your CDs, convert your WAVs and import MP3s into the Zortam library

There are also bookmarks and playlists. Right-clicking a track enables you to bookmark it or add it to a playlist. The library can be exported to CSV or HTML, and printed.

Select a track and the information stored in the MP3 file is displayed in a panel. It is a trivial task to enter the information for an MP3 or to edit the current details and there are boxes for the artist, track title, album name, track number, year and genre. If you rip CDs then all of the tags are filled in automatically. If you have old MP3 files that use the old ID3v1 tag standard to store information, they can be converted to ID3v2. You can also convert from the newer to the older format and there are batch commands to change multiple files at once. The volume of MP3s can be normalised to make them all the same volume, which they may not be if they are from different sources.

The program can find album artwork on the internet, download it and add it to the library. It can also find the lyrics too, and these are displayed on a tab in the MP3 details panel. There is a player panel and tracks can be dragged and dropped on it to create a playlist.

Zortam MP3 Media Studio is a cheap program and a great tool if you want to create and maintain a library of MP3 music. It has a lots of tools for creating, editing, finding and performing other functions on MP3 tags and you can rip or import your music. There are many graphics skins that enable you to change the look of the program, including an old iTunes brushed metal style, and it is easy to use. Try it if you have lots of MP3s you want to organise.

mm Roland Waddilove

A useful alternative to the major music players

GROUP TEST

Benchmarking Software

Benchmarks are the life blood of the system tester and builder. Although a benchmark number is often seen as a badge of honour for overclockers and such, it's also an excellent way to test your system for bottlenecks and to see if the components you've selected work well together.

David Hayward runs his PC through six benchmark tools and packages and sees which offer the most value for the discerning tester.

Benchmarking Software

Futuremark 3DMark 11

DETAILS
- **Price: Free to £643**
- **Manufacturer: Futuremark**
- **Website: goo.gl/OOIN2b**
- **Requirements: Windows Vista or later, 1.8GHz dual-core CPU, 1GB RAM, DirectX11 1.5GB HDD space**

Futuremark's 3DMark became the de facto benchmark software some time ago, and with the launch of DirectX 11 it then went on to be an absolute necessity when it comes to measuring one system's performance against another.

It's designed to measure the computer's gaming performance using all the newest elements and features inherent to DirectX 11, which include tessellation, compute shaders, GPU and combined CPU stress testing and multi-threading.

There are three versions of 3DMark 11 available. The Basic version, which is free, includes everything you'll need to get the much coveted 3DMark Score locked in the Performance mode preset at 1280 x 720, with a moderate load suitable for most gaming PCs.

The Advanced Edition costs $19.95 (£12.90) and allows you to measure your system using all three 3DMark presets – Performance, Entry and Extreme – along with unlimited results storage and benchmark looping for stability testing and system burn-in. It's worth noting that the Advanced Edition is also available through Steam, as well as Futuremark.

The Professional Edition of 3DMark 11 is designed more the industry level benchmarker, as opposed to the gamer or enthusiast. As a result, it costs $995 (£643) and includes everything from the Advanced solution as well as custom testing options, command line execution and automation, demo looping, offline results and priority support. It's bought as a site licence generally, with the option for a press licence as well.

There are four different tests available: Deep Sea 1 and 2, High Temple 1 and 2, Physics Test and the Combined Test. All of these will stress your graphics capabilities by displaying spot and point lights, volumetric illumination, tessellated geometry, depth of field and shadowing. There are also pure CPU performance tests involved, using rendering techniques, multi-threading simulations and collisions using the Bullet Open source Physics Library – a standard used for Hollywood effects in films such as *2012*.

It very simplistic in its testing methodology

micro mart
Quality 7
Value 7
Overall 7

What all this ultimately means, though, is a final score that can be used in one of two ways. The first is to check and compare the scores with the industry standards, to see if the system you're building is showing the intended results and to check for overclocking stability when used in graphical environments. The second, however, can be taken down to the pure base level of bragging rights.

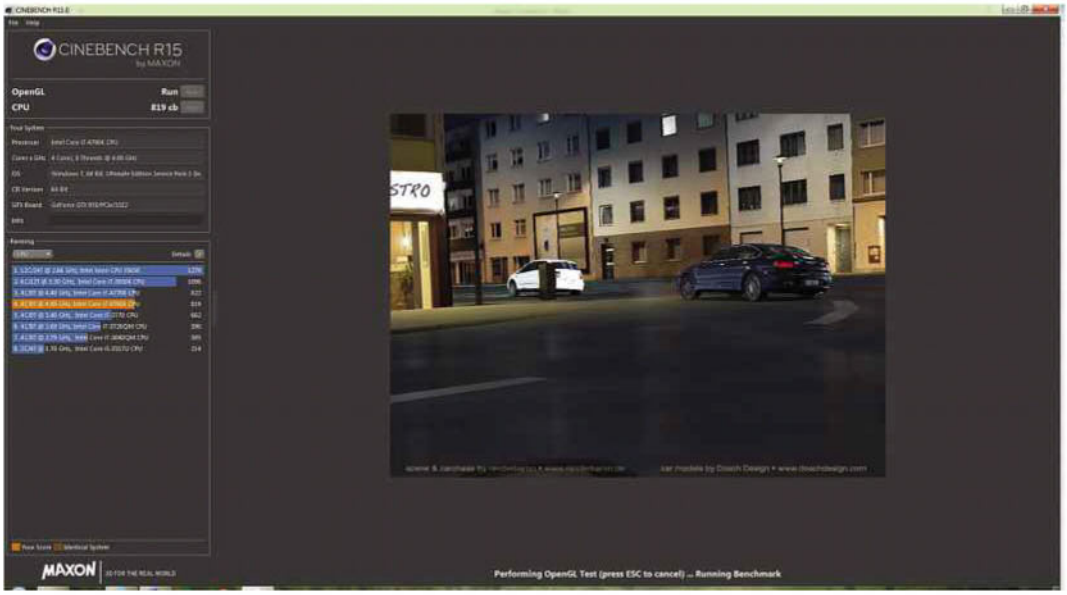
Yes, indeed, building a system that has a final 3DMark 11 score in the thousands is an incredible achievement, but there's also the fact that a weighty part of the community are purely doing this to get one up on the other gamers and testers out there.

Naturally, professional benchmarkers and system builders use the number generated to display the prowess of their systems or to highlight a new graphics card, CPU or combination of both. The motherboard manufacturers also get in on the scene, especially if their product is one that was used in a record breaking score or some other kind of extreme benchmarking result.

Futuremark 3DMark 11 is the poster child of benchmarking, but that doesn't mean it's the best all-rounder. Those who simply want a solid, cross component benchmark may need to look elsewhere. Those who want to see how their new GPU performs, 3DMark 11 is certainly the one to go for.

Maxon Cinebench

DETAILS
- **Price: Free**
- **Manufacturer: Maxon**
- **Website: goo.gl/pKtkOJ**
- **Requirements: Windows 7 or later, Mac OS X 10.6, 1GB RAM, OpenGL card**



The rather simplistic look of Cinebench may deter the avid benchmarker

The two tests don't reveal much in terms of the scores and what's being tested

The benchmark purists among you may regard Maxon's Cinebench as more of a fancy display suite rather than a fully fledged benchmarking tool. However, there's more to this program than you first imagine, and the results can be taken quite seriously.

Cinebench is designed by Maxon, which has based it on its award winning animation software Cinema 4D. It tests both the graphics capabilities and the CPU by rendering a selection of photorealistic scenes and animations. The algorithms involved really stress both the GPU and CPU on all their available cores by computing thousands of objects, hundreds of thousands of polygons, reflections, lighting, shadows, shaders and anti-aliasing to finally display a score based on the points accrued during the tests.

Despite that, there are only two tests: an OpenGL test that involves an animated 3D car chase that looks like it was developed for an Amiga, and a CPU rendering test that draws a complex image on the screen. You don't get any indication of the frames per second, the limits on the CPU or GPU during the tests, just as part of the final score, which is then entered into a ranking table along with the results of other GPUs and CPUs.

To a point, then, Maxon Cinebench is more of a real-world test rather than a benchmarking tool of choice for system buildings and performance testing connoisseurs. There's an Advanced Benchmark option, but this only included a single-core use of the second CPU test; other than that, there's little else to test, detail and benchmark against.

Despite all that, Cinebench can still used as a part of the benchmarking process for CPU, motherboard and GPU combinations, but it's losing popularity in favour of 3DMark11.

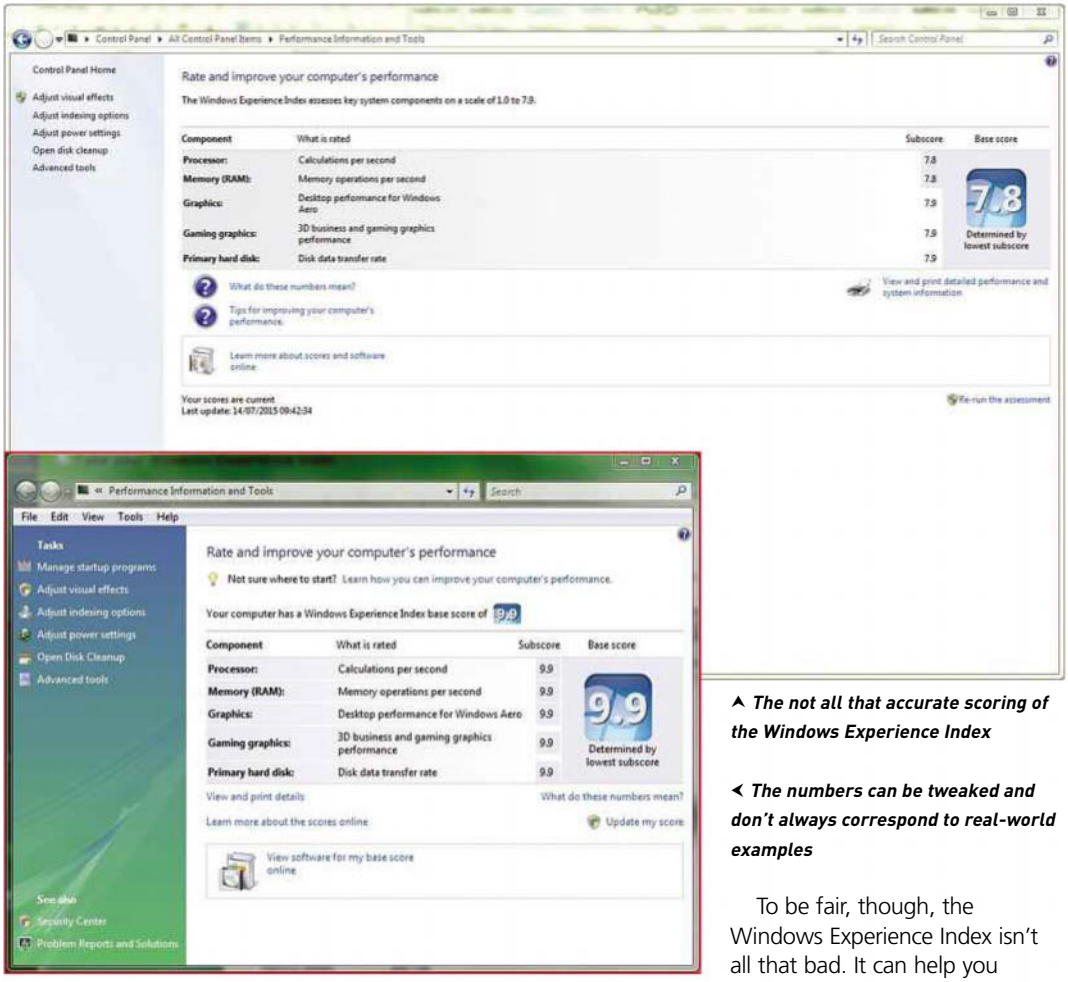
There's a fair bit of processing going on in the background when the tests are being executed. You can tell from the strain on the system and the fact that the fans are kicked into life to the point where your PC sounds like a jumbo jet. So while you could argue that the tests appear to do very little, they certainly give the system a good workout.

Beyond the two tests, which take a few minutes to complete, there's very little else to add. Cinebench is thankfully free and will work on both Mac and Windows based systems, which is good, as there would be little to recommend it if Maxon decided to charge for the software. And it's worth noting that it doesn't need installing, so there's little to no chance of anything clogging up your perfectly tweaked setup.

If you want a very quick comparison against a handful of CPUs and GPUs and you're dead set against installing anything, then Maxon's Cinebench will no doubt suffice. Otherwise, it's hardly worth the bother.

Windows Experience Index

DETAILS
- **Price: Free**
- **Manufacturer: Microsoft**
- **Website: goo.gl/S9M4At**
- **Requirements: Windows Vista or later, Windows 8.1 optional download or via command line**



The not all that accurate scoring of the Windows Experience Index

The numbers can be tweaked and don't always correspond to real-world examples

The Window Experience Index (AKA the Windows System Assessment Tool – WinSAT) first appeared as a module in Windows Vista as Microsoft's attempt to create a base score for all PCs so buyers could better ascertain which systems would run the OS better than others. In theory, it was a good idea, but it didn't quite work out as well as planned.

Basically, the WinSAT portion of the module runs various tests on the processor, memory, 2D graphics – in the form of desktop performance for Windows Aero, 3D graphics for 3D business and gaming graphics and the primary hard drive. The numbers are then displayed, and the lowest of them then becomes the base score for the system tested.

The numbers generated differ from one version of Windows to the next. The initial Windows Vista release reported a scale of 1.0 to 5.9; Windows 7 went up to 7.9 and Windows 8.1 (which was pulled to begin with, but has since been re-instated with the installable WEI tool or available as a command line option) goes up to 9.9. The problem was, no one really knows what those numbers mean.

The scores were only ever as good as the hardware was at that time, so a perfect score across the board in Windows 7 would only score 5.9 in Vista. And a system that's many times more powerful would still score 7.9 in Windows 7, which ultimately gives no indication as to which is the better performer.

The idea behind WEI was to quickly determine where a bottleneck lay in your system. For example, if your 2D graphics section scored less than 3, then the Aero effects would be automatically turned off, and you could then go on to investigate ways to invest and improve the score until it peaked at its maximum. It's handy enough, but hardly a number that can be followed rigidly.

There were classic examples where an extremely low scoring WEI PC could easily beat a higher scoring PC when gaming or just in basic PC duties. The numbers involved were ambiguous at best and often resulted in many an argument in the collective forums.

Despite that, many people still insist on comparing the Windows Experience Index scores from one machine to another or compared to their older PCs. This is where the problem mainly lies with WEI, in that a reported score of 5.0 on the 3D gaming graphics to an upgraded score of 7.9 doesn't mean that *The Witcher 3* is going to run at 1080 with every graphical option set to the highest. Granted, it doesn't state that anywhere in MS literature, but the feeling that a full 3D graphics score will run the latest game is very misleading.

To be fair, though, the Windows Experience Index isn't all that bad. It can help you determine, to a lesser degree, where you can spend your upgrade money, without getting too technical. But for serious use or to determine how the latest game will run on your system, you're better off with the likes of 3DMark or PCMark.

Futuremark PCMark 8

DETAILS
- **Price: Free to £966**
- **Manufacturer: FutureMark**
- **Website: goo.gl/0KGlRh**
- **Requirements: Windows 7 or later, dual-core CPU, 2GB RAM, DirectX9+, 30GB HDD space**

PCMark 8 is the sister program to the Futuremark main product, 3DMark 11. The difference here is the fact that PCMark is more of a whole system benchmark solution, rather than being focused on gaming, DX11 and graphics, like the 3DMark tests are.

PCMark has been around since 2002 and has evolved and matured into an industry leader in benchmark testing. Futuremark has spent considerable time fine-tuning PCMark so that it's more relevant to a real-world benchmark. By this we mean it uses real-world tasks and applications to create scored scenarios that will reflect the average PC when used at home or in an office.

There's a focus in version 8, which has been around for well over a year now, on web browsing, SSD performance and OpenCL GPU Computing. The tests themselves are split into six main themes: Home, Creative, Work, Storage, Applications and Battery Life Testing. When combined, these will produce a score based on all aspects of the system in question.

As with 3DMark 11, PCMark 8 has several versions available. The Basic Edition is free and allows you to test your PC with the Home, Creative and Work set of benchmarks. The Advanced Edition costs around £32 and includes all five of the main performance tests and the battery life test should you be running it on a laptop. You'll also be able to single out SSD and HDD tests in the Storage section, run individual workload tests to help fine tune your system, and you'll receive in-depth hardware graphs and charts detailing any potential bottlenecks your system may have.

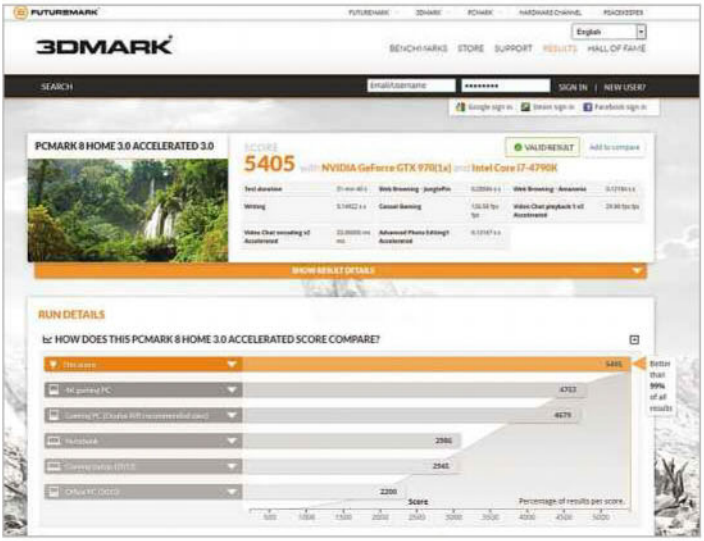
Finally, the PCMark 8 Professional Edition will set you back a cool £966 or thereabouts after monetary conversion, and it features all of the above plus expanded storage tests, command line automation and scripting, offline results, export results as XML or PDF, and you can target Adobe and Microsoft applications for further testing and monitoring.

The Professional Edition is for companies using a site licence and can be used to test the performance impact of certain operating systems or programs prior to them being installed across the company. The home user, though, gets a reasonably good benchmark suite, which for the most part is a good indication of how a particular PC will operate under 'normal' duties.

The fact that PCMark is more general use rather than having a gaming bent makes it a little more appealing to those who are after a good general use PC and IT teams. Trying to persuade your employer's finance director to part with a chunk of the company's capital based on a 3D gaming benchmark obviously won't get you very far. The same goes for the home user; if the PCMark 8 score was displayed next to a PC for sale on the shelves, then the user may take more notice, especially if it was more universally accepted.

PCMark 8's strength lies in the fact that the results are easy to analyse and compare. For that alone PCMark 8 is well worth considering, but the hefty 2.9GB download is somewhat extreme, just for a potential one-off installation and execution.

The many tests PCMark 8 runs through are quite comprehensive

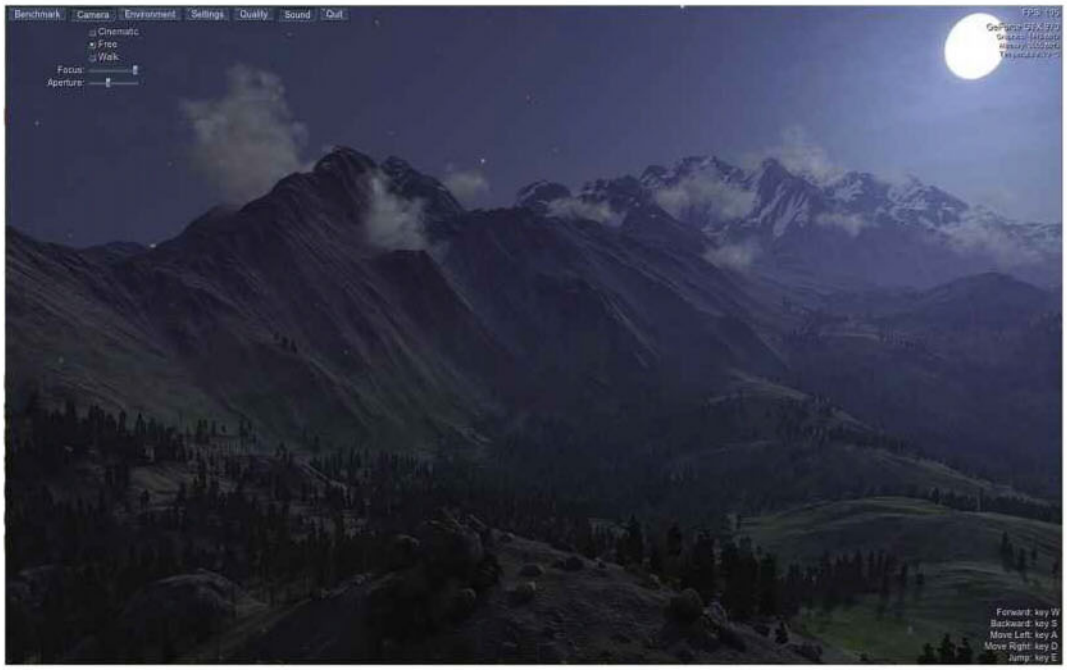


The final score is very much the same as 3DMark11: easy to understand

micro mart
8 Quality
7 Value
8 Overall

UniGine Valley Benchmark

DETAILS
- **Price: Free**
- **Manufacturer: UniGine**
- **Website: goo.gl/zMTD7M**
- **Requirements: Windows 7 or later, 2GB RAM, DirectX 9/11, OpenGL G/card**



▲ *The setting for the UniGine Valley benchmark is certainly magnificent*

➤ *The benchmark results can be a little bleak, though*

UniGine is the commercial game making engine that allows you to design multi-platform game environments. As a result and because of its use in the industry, the company has on offer a number of GPU stress testing tools available.

There are a four main benchmark stress testing tools for download: Valley (which is what we're reviewing here), Heaven, Tropic and Sanctuary.

The Valley model has you flying through a peaceful forested valley, with golden motes floating between the foliage and trees and culminating in a storm with lightning strikes and raindrops for added effect – all against the impressive backdrop of a glorious mountain range.

Heaven has you in a steampunk world of floating islands, magical places and mediaeval villages. Tropic is fairly self explanatory, while Sanctuary has you touring a gothic cathedral, with ill-lit corners and plenty of torch light. The four tests are very dramatic, and as well as being visually impressive they do put the GPU, CPU, memory and system through their paces.

From the main UniGine window you can choose your language; a preset graphical test from Custom, Basic, Extreme and Extreme HD; API allows you choose from DirectX 11, 9 or OpenGL, and Quality settings ranging from low, medium, high and ultra. And you're able to opt for stereo 3D, multiple monitors, anti-aliasing, full screen and a choice of resolutions.

Once you run the benchmark, you have a choice of flicking through the preset scenes or taking a walk – or fly – around the 64,000,00 square metre detailed landscape. Meanwhile the frames per second, the model of graphics card you have in the system, its clock speed, available memory and temperature are all displayed in the upper-right corner of the screen.

There are numerous controls along the top that start the system benchmark, alter the camera from static to user controlled, change the environment from a sunny day to a full tropical storm at night and alter the quality settings. You can also turn off the sound effects, in-benchmark music and quit the benchmark altogether.

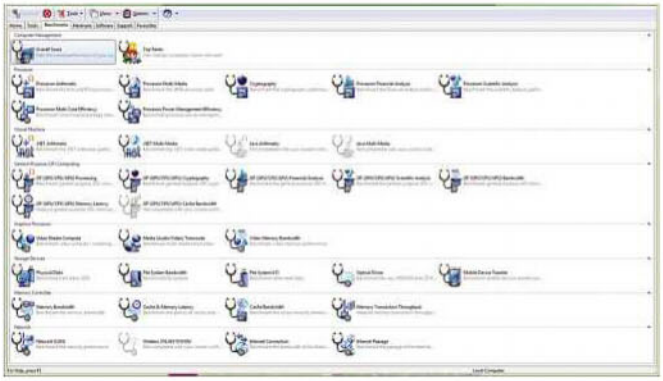
In the background there's a fairly intensive hardware stability testing going on, along with testing dynamic skies, volumetric clouds, sun shafts, DOF and ambient occlusion. The result, when the benchmark has completed its run of the various scenes, is a score based on the average, minimum and maximum frame-rate depending on the settings used and as configured by the user. There's also a brief summary of the platform and hardware used, as well as the benchmark settings.

The UniGine benchmarks aren't as popular as the 3DMark 11 benchmarks at the moment, but they're still in use by many testers. It would be good therefore to be able to, at a quick glance, see how your system score for the settings compare to other systems. However, it doesn't, so you'll have to go searching for that information yourself.

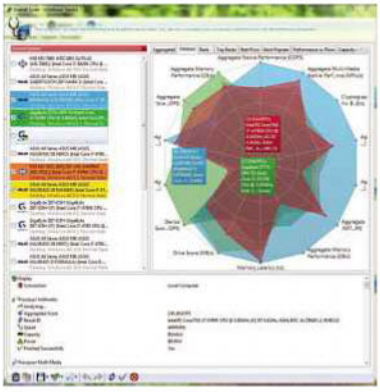
Still, the UniGine benchmark, in particular the Valley benchmark, is very pretty and absorbing to look at and play around in.

SiSoftware Sandra 2015 SP2b

DETAILS
- **Price: Free to £4324**
- **Manufacturer: SSoftware**
- **Website: goo.gl/ez14sM**
- **Requirements: Windows Vista or later, Android, Windows Phone**



The benchmarking abilities of Sandra 2015 are astounding



The results, however, can be confusing to look at

SiSoft's Sandra (the Sytem ANalyser, Diagnostic and Reporting Assistant) had a recent upgrade last November with the 2015 edition and followed by SP2b, which was released on 6th July this year. Better support for all current versions of Windows along with Windows 10 were included with the new version, along with updated hardware, Device Performance Certification, new GPU, APU and CPU Scientific Analysis Algorithms and an updated overall score. There were also many other tweaks and improvements to the main structure of the program itself and a dash of Windows 8-esque flair with a set of new styles and themes.

The program itself comes in a variety of versions. There's the Lite free version, for personal system use; a Personal edition, for the home enthusiast and costing around £30; a Business edition, for OEMs and the like, costing £123; a Tech Support version, which can cost anywhere up to £1,140 with an added 16GB USB flash drive, which naturally is designed for someone in a professional technical support role; and finally there's the Enterprise version, which does pretty much everything and more and costs a pretty pound or two – up to £4,324 of them.

Nearly every component on the PC is tested, measured and detailed to the extreme. The CPU, chipset, GPU, ports, printers, audio devices, memory, network, Windows internals, ODBC connections… you begin to get the idea. They're all tested and reported on thanks to the pages upon pages of different modules that are loaded when the program starts its benchmark.

While this may seem a little overboard to some, it does mean that your system will get a thoroughly good shake down. The pretty videos that 3DMark 11 display aren't present, and you don't necessarily get to hold the bragging rights over your friends as to who has the best gaming PC, but you do get one of the best and most detailed reports of any benchmarking software.

With the numbers generated you can opt to have them made public, based on the make and model of the hardware you're testing and any global benchmarking teams you may belong to. So in some respects there is an element of bragging rights.

> **"Sandra has everything a competent, technically minded benchmarker is after"**

How much faith you put into the tests run is up to you, though. There was some talk a while back of the tests being somewhat synthetic in nature, although that could well have been unfounded rumour. Even if you have little regard for the tests themselves, you can't deny the sheer statistical data that Sandra displays.

It may not be the prettiest benchmark product around, but Sandra has everything a competent and technically minded benchmarker is after. With Sandra you can stress test and have reports generated on every conceivable aspect of your system, which makes it much more useful in the long run for locating potential problems or tweaking than 3DMark 11.

The problem, though, is how the results are displayed. While great for the technically minded, the casual benchmarker may really not care for the General Processing GPU/CPU/APU overall score. Compared to the final, single score of 3DMark 11, you can see how Sandra has fallen from favour over time. Still, it is by far the most comprehensive of the benchmark tools on test here.

SiSoftware Sandra 2015 SP2b

In terms of pure benchmarking abilities, SiSoft's Sandra 2015 SP2b is by far the most comprehensive package available.

It may not look particularly pretty, and the results are confusing to figure out at times, but the sheer volume of data and information is amazing. However, it is rather pricey beyond the free Lite version.

Futuremark PCMark 8

FutureMarks PCMark 8 is a great benchmarking tool for most average system owners. It doesn't delve into the gaming aspects too much, not like 3DMark 11 or UniGine, but it's certainly worth running your system through.

How We Tested

Each benchmark was tested on a Windows 7 64-bit installed PC with an Intel i7-4790k at 4GHz, 16GB memory, Nvidia GTX970, a 120GB SSD and a 1TB secondary HDD. Aside from Cinebench, which didn't require installation, all benchmark products were installed to the SSD.

	3DMark 11	Cinebench	Windows Experience Index – Windows 7 version	PCMark 8	UniGine Valley Benchmark	Sandra 2015 SP2b
Price Range	Free – £643	Free	Free	Free – £966	Free	Free – £4324
GPU Tested	Yes	Yes	Yes	Yes	Yes	Yes
CPU Tested	Yes	Yes	Yes	Yes	No	Yes
RAM Tested	No	No	Yes	Yes	No	Yes
HDD/SSD Tested	No	No	Yes	Yes	No	Yes
OS Tested	No	No	Yes	No	No	Yes
Applications Tested	No	No	No	Yes	No	No
Windows Components Tested	In conjunction with G/C drivers	No	Yes – DirectX compatibility	Yes – DirectX, browsers, word processing	Yes – DirectX	Yes
Other Hardware Tested	No	No	Yes – drives	Yes – drives, battery	No	Yes – ports, connected devices etc.

Remembering...
Intel 486 DX2-66

David Hayward recalls an awesome processor

Moving up from an Intel 386 SX-25 to the utterly amazing Intel DX2-66 was one of the most powerful leaps in computing I've ever experienced; save for, perhaps, a Spectrum 48k to Atari ST. The DX range of processors were a quantum leap forward in desktop computing. The 386 DX had doubled the transistor count from the old 286, quadrupled the MIPS performance across the board and brought true 32-bit processing to the desktop masses. The memory address range was also vastly improved; up to 4GB of RAM or 64TB of virtual memory in protected mode – numbers considered almost too high to comprehend back in the 90s. The 486 DX was the first processor to feature a built-in Math Co-Processor and the first processor to finally break the one million transistor barrier.

The DX2-66 was the ultimate in gaming processors. It was fast, had an extra 8KB of on-chip cache and was priced just right for early DOS gamers to enjoy the benefits of an amazing gaming setup, where the likes of *Doom* and *X-Wing* ran beautifully.

History

The first of the 486 range of processors was introduced late in 1989, with the vast majority of the PC desktop world really getting to grips with the new line by the first quarter of 1990. The performance of the 486 was a vast improvement over the previous 386 processor range, and when used with the improved graphics cards, memory and hard drives of the day, combined to make a system that was unparalleled in the computing world outside of a university computing lab or research facility.

The first 486-DX chips ran at 20, 25, 33 and 50MHz without the clock doubling, then within a year or so a 486-SX version appeared, at a lower cost but with the floating point element missing or disabled. By mid-1992, the classic Intel 486 DX2-66 was launched, with slightly improved versions the following year.

The clock speeds further increased, until around 1994, when the DX4 range was introduced. The DX4 ran at triple clock rates, allowing a base clock speed of 100MHz and featuring either write back cache or write-through cache depending on the model.

Finally, though, the public warmed to the Pentium which was released in 1993. The first batch of Pentiums hadn't been received too positively, having been shown to have had some issues with gaming and, in some instance, a faulty floating point. By the time the second generation of Pentiums were available, however, the old DX range were long gone and developers were already taking advantage of the newer and more powerful processors.

The Good

At the time, this was the top of the range in terms of gaming and a blisteringly fast processor compared to what came before.

The Bad

Although I can't ever recall experiencing this, there were reports of the cache causing problems in some games, most notably *Wing Commander*.

Conclusion

The 486DX2-66 was a great processor and one of the first CPUs where we actually chose as part of a home built system over the previously more popular off the shelf varieties.

It was the start of PC computing for a lot of us, as well as higher end PC gaming in general. It soon became the holy grail of ownership; to say you had a DX2-66 inside your machine as you typed in the command to run *Doom*, while your friends looked on with an envious eye, was what it was all about.

Did You Know?

- The AMD version, the AM486 DE2 and DX2-66 was much cheaper than the Intel DX2-66, but it didn't perform quite as well.
- The 486 DX range introduced Pipelining, which was previously only reserved for mainframe computers.
- Intel had a choice of either running with the 486 range of processors or its new concept i860 RISC processors. Compaq pressured Intel to run with the 486, while, interestingly, Microsoft pressured Intel to put all its effort into the i860.
- The move from an SX-25 to a DX-66 alllowed *Wolfenstein* to look better than ever.

The Intel 486 DX2-66, a wonderful processor and a massive advance

With a DX2-66 inside, Gaming on a PC had never looked – or been – so good

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Edit Photos Anywhere

Roland Waddilove reveals 15 of the best photo editing tools for the web, smartphones and tablets, and the PC

How do you edit your photos? Using a specific piece of software, online tools in a web browser, or with your mobile phone? All three platforms have advantages and disadvantages and here we take a look at each one, picking the best that each has to offer.

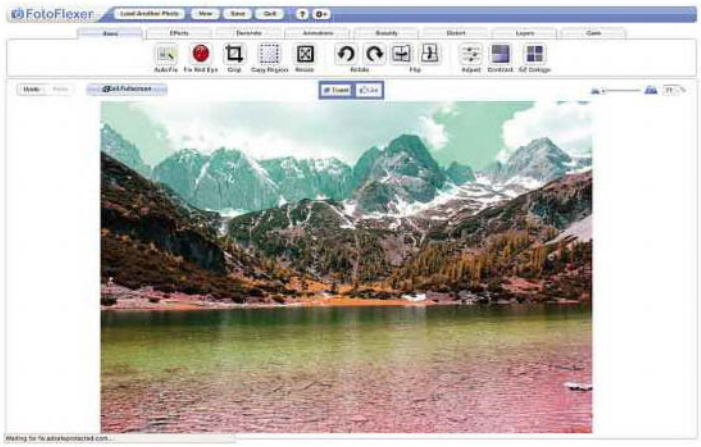
You might assume that desktop software is the best option, but that's not always the case – and these days, where we take snapshots and immediately upload them to a social network or send them to friends via instant messenger, we often don't want to wait to home, transfer them to the computer, fire up Photoshop, edit them, save them, then post them online. We want to edit quickly and share them immediately.

Online photo editing has come a long way and many people could switch to editing snapshots online in a web browser instead of on the computer – and if you have a Chromebook, online editing is your only option. Web apps are surprisingly good now, though, and might make you reconsider whether you actually need PC software.

Online Photo Editors

It is easy to dismiss online photo editing apps that run in a web browser as not being good enough, especially if you tried them a couple of years ago and were not impressed by what you found. The two most obvious concerns is the need to upload large images that are many megabytes, and the limited range of features provided by an app that runs in a browser.

Computers are faster than they used to be, and so are web browsers. This means that online software is much more powerful and offers more features than a few years ago. Online apps are getting better as web technologies improve and the features and functions of online photo editing apps may be better than you imagine. In fact, some of the best online photo editing apps are better than some budget Windows programs running on the PC. You may be surprised by the capabilities of modern web-based applications and they are well worth trying if you are not familiar with them.



FotoFlexer is aimed at casual users who want fun photo effects

The need to upload photos is still an issue, but it is less of a problem than it used to be. Fast internet connections are common and many people now have fibre optic or cable connections of 20Mbps, 50Mbps or more. Internet Connections are still not fast enough for complex work with large RAW digital camera files using multiple layers to build up images, but it may not be long before that's possible too.

These days it is common to shoot photos on an iPhone or Android phone and upload them to online storage, social media or the PC. File sizes tend to be around a couple of megabytes. Files of around 2MB can easily be edited with an online photo editor. In fact, some seem to load and save photographs almost as fast as when you're working with files natively on a PC – in fact, you may well be surprised at the speed and quality of some of these apps.

FotoFlexer

FotoFlexer (**fotoflexer.com**) can load photos not only from the disk drive, but also online services like Facebook, Flickr, and Picasa. The editor and photo then appear in the browser. The advertising banner is irritating, but the full screen button removes the browser and ads, and just shows the editor.

This is a good online editor that has some useful features that you don't find in some PC-based photo editors. There are eight tabs and these provide access to the tools and effects. The Basic tab has an Autofix button, but also manual controls for adjusting the brightness, contrast, saturation, red-eye fixer, resize and so on. The Effects tab provides access to around 30 filters, like the ones you get in Instagram and other mobile apps. For example, comic, pop art, sepia, bronze, old photo, posterise and so on. There are also fun features like stickers, glitter text, and even animations.

PhotoCat

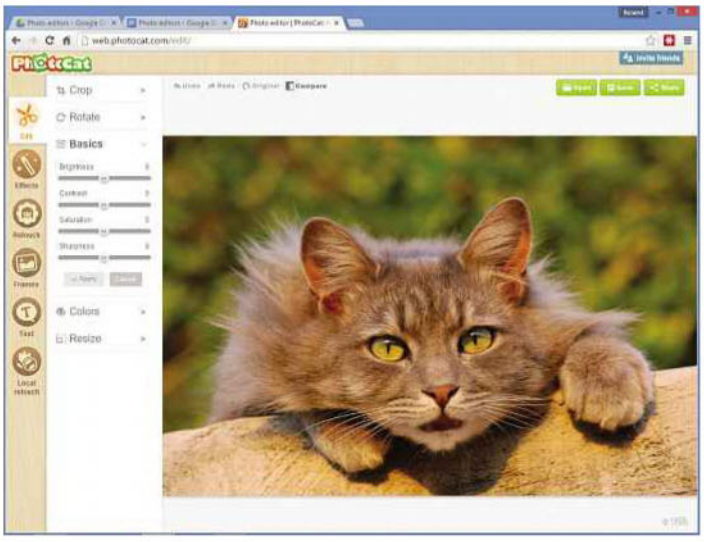
There are millions of cat photos on the web, but thankfully none in PhotoCat (**photocat.com**); it is just a great online photo editor. It has a modern and clean design, that marks it out to be fun rather than a serious photographer's tool. Most people, however, will find its range features perfect for their needs.

Tools are on tabs down the left hand side and there are edit, effects, retouch, frames, text and local retouch tabs. It has all the usual brightness, contrast, saturation and other controls, and a nice collection of filters, but it also has some fascinating and unusual tools too. For example, The slimming tool can take pounds off your figure, spray tan, blemish remover and blush makes skin look perfect, eyes can be enlarged, coloured, and even mascara added, and there is lit tint too. All these plus regular photo editing tools make this a fun and useful tool.

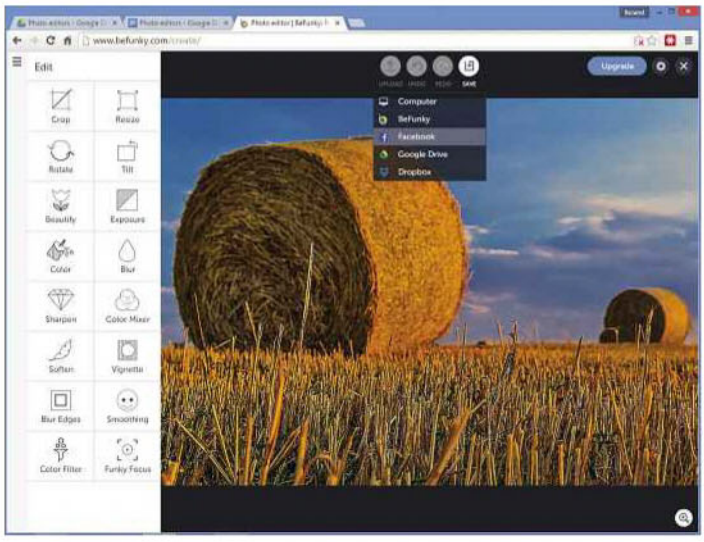
> **"Online software is much more powerful and offers more features than a few years ago"**

BeFunky

BeFunky (**www.befunky.com**) is another excellent online editor that appears as though it is designed to be fun, rather than to be a serious alternative to Photoshop. The interface is nice, and uploading and downloading photos is quick. The toolbar on the left expands when an icon is clicked and there is a good collection of image enhancement and fun tools. The Edit pane provides all the usual tools you would expect – like crop, rotate, tilt, exposure, sharpen, smoothing and so on – but the other panels is where the fun starts.

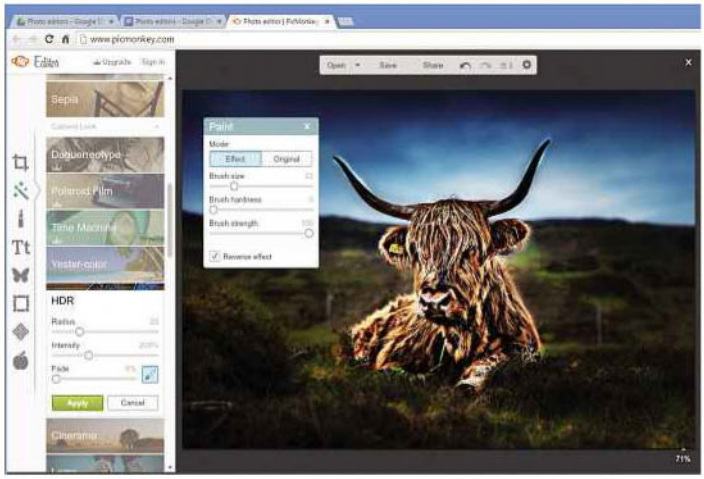


It's just a coincidence a cat is being edited on PhotoCat



BeFunky has a great interface and no distracting adverts, just photo tools

Pixlr is the closest there is to a traditional PC-based photo editor



PicMonkey has irritating adverts, but some excellent touch up tools

Touch Up offers tools like Eye Colour, Lipstick, Blush, Wrinkles and several more designed to make people look good. There are dozens of filter effects that apply the usual colour casts, pop art, ageing, monochrome and so on. Images can be turned into artwork like sketches, oil paintings and more. More panels provide text facilities, overlays, graphics, frames and similar items. There is also a collage maker for combining several photos into different layouts.

Pixlr

Pixlr (**pixlr.com**) has not one, but two photo suites: Editor and Express. The latter is a simpler version of the software, designed for quick fixes, overlays and borders, while Pixlr Editor is more a traditional fayre where you can load images from your computer, Facebook and other places to work on, or start with a blank sheet and build up or draw an image. The interface offers resizeable and moveable windows for the photo, tools, and tools options, and they can be dragged and placed anywhere withing the larger browser window.

There are too many photo editing tools to list in this article; Pixlr isn't quite Photoshop in a browser, but it is not far short of equalling the much-loved open source software known as GIMP (GNU Image Manipulation Project, in case you were wondering). It has multiple layers for example, and you can work with selections, so you can adjust a layer or selection brightness, contrast, saturation, and so on. There are also special effects filters, red-eye removal, sponge, smudge, burn and more.

PicMonkey

PicMonkey (**picmonkey.com**) provides a large collection of image enhancement tools, but is more like FotoFlexer, PhotoCat and BeFunky than Pixlr. It enables you to apply a wide range of effects to an image – though they are not just whole-image adjustments, you can do some fine detail work too. For example, on the Effects tab is a collection of over 30 effects like HDR, Dusk, Boost, Soften, Polaroid Film and so on. An effect can be applied to the whole image, but there are options to apply them to just the parts you want.

There are also the usual crop, rotate, exposure, colours, sharpen and resize facilities and you can easily fix the saturation, brightness, focus and other problems. The collection of Touch Up tools is excellent and there is blemish fix, wrinkle remover, spray tan, teeth whitener, eye liner, mascara, eye shadow, eyebrow pencil and more. These are obviously fun effects rather than serious photographer tools.

Mobile Photo Editors

One of the attractions of editing photos on a mobile phone is that everything is self contained. You shoot a photo on the phone, edit it on the phone, and then share it online using Facebook, WhatsApp, Flickr, Instagram, and so on. There is no need to transfer photos to a computer, load a heavyweight photo editing app and spend hours touching up snapshots. It takes just a few minutes and the touch interface on your smartphone makes the whole process a lot simpler than the complex menus and tools offered by PC software. The drawback is that editing is, of course, less precise.

There are hundreds of photo editing apps that perform very similar functions and a common one is the filter. You select a filter from a library and apply it to the whole image – and turn it black and white or sepia, invert the colours, age it, boost the colours, apply colour casts and so on. It is less common to be able to apply special effects to part of an image, though; for example, you may have dark areas that you would like to lighten, but selectively lightening just a part of the image may not be an option.

Title and caption functions are typically in photo apps. These enable you to write a title and add text to the image. A range of fonts, sizes and colours is often provided. Borders are a staple of

Photoshop Mix adds extra cut and paste features not in Photoshop Express

PicsArt is one an excellent and powerful photo editors for Android and iOS phones

Pixlr is a great photo editor for Android and iOS and it also makes collages too

The quantity and quality of effects and tools in Photo Studio is excellent

photo apps and there is usually a collection of ready-made ones that can be applied with a couple of taps.

Detailed editing is often not available and partly this is because the small screen of phones, and even tablets to some degree, make it awkward. Also the finger is a blunt instrument that is very imprecise compared to a mouse pointer.

Photo apps are definitely fun and the drawbacks, such as limited tools, might not bother you. Many phone users simply take a snapshot, apply a filter and share it. Apps are brilliant for this, but are less useful for serious photographers. Here are five photo editing apps for iOS and Android you should try on your smartphone.

Photoshop Mix

Adobe produces many mobile apps and, while Photoshop Mix is less well known than Photoshop Express, this one is useful for certain functions. One of its main draws is the simple, intuitive cut and paste facility; you can select an object, person, animal, or whatever you want in one photo and then paste it into another as a separate layer with great ease. The app must include some clever edge detection because the selection is very good, despite using a fat finger on a small screen. There are basic and smart selection tools, and feathering.

Another feature is the collection of filters that can be applied to photos. It departs from the usual format though and after selecting a filter, you paint it into the image. This enables you to apply different filter effects to different parts of the photo, and to combine effects. With some, the image is uploaded to Adobe Creative Cloud where it is rendered in the best possible quality and downloaded again.

PicsArt Photo Studio

PicsArt Studio is one of the top photo editors for iOS and Android. The app performs many photo related functions and there is a great editor for enhancing snapshots. You can take photos directly, load them from the phone's storage, download them from Facebook and more.

A panel appears on the left that provides access to tool categories. There is FX, Blur, Artistic, Pop Art, Paper, Distort, Colours and Corrections. Each category has up to 25 effects and there is a huge range to choose from. Many are similar to other photo apps, but there are some unusual ones too. For example, the Corrections category has tools like red eye, colour eye, blemish fix, suntan, and teeth whitener.

In addition to special effects, there are traditional photo editing tools. For example, the app lets you create multiple layers and to paint, draw, insert text, or add effects to layers and set the opacity.

Photo Editor- applies effects to the whole image, but is otherwise good

The clone tool in PhotoScape. There are few tools, but lots of adjustment and effects

Phoxo has turned a photo into an oil painting and now the clone brush is being used

Autodesk Pixlr-o-matic

Autodesk has a simple and fun photo editing app called Pixlr-o-matic that is worth considering and it enables you to apply a wide range of fun effects to photos. Pixlr is a better photo editor though, and it has an excellent range of features for a mobile photo editor.

Take a photo or load a previously taken one and along the bottom of the screen is a toolbar with Adjustment, Effect, Overlay, Borders, Type, and Stickers. Selecting one opens a palette of tools and effects, sometimes as many as 19. There are automatic tools like Auto Contrast and Auto Fix, and others that offer more detailed options, such as Brighten, which you paint on with a brush.

You can select lots of effects and adjustments, and compare it to the original before committing them all. When you have finished, the image can be shared to the usual Facebook, Twitter and Instagram, or saved.

KVAD Photo Studio

This is another feature-packed photo editing app for iOS and Android and it has excellent features. There are a lot of free features, but also Pro tools that require payment. There are filters, effects, frames, shapes, blending layers, stickers, sketch, text, Colour Splash and Paint. In each of these tool categories are many tools, for example, there are 170 filters. Not all are free, but around 40 are.

There is a small number of effects that add fire, ice, swirly lights, and colours. Around 25 frames are available, including plain and fancy ones. There are dozens of shapes of all types and you can set the colour and transparency. Dozens of ready-made stickers can be applied, like 'Wow', 'Well Done', 'Awesome', and so on. Colour Splash removes the colour from a photo and then lets you paint in selected areas. There are over a hundred effects, with several dozen of them free.

Photo Editor-

Photo Editor- is packed with tools and you can create some great artwork from your snapshots by applying effects, filters, frames and stickers. The interface is clean and simple, and along the bottom of the screen are around 20 tool categories. There are 13 effects, with more available to be purchased in its store. These apply various colours to age them, apply colour casts or simply for fun. There are 13 frames for free, mainly plain and simple ones, but there are better ones in the store. There are overlays (shapes) and stickers too.

Basic correction tools are provided and you can crop images, adjust the brightness, colour, sharpness and focus. There are some useful repair tools, like the red-eye remover, the teeth whitener and the blemish remover. You can draw on the image with markers of different sizes and colours, and text can be added. The finished image is saved back to the phone's gallery.

PC Photo Editors

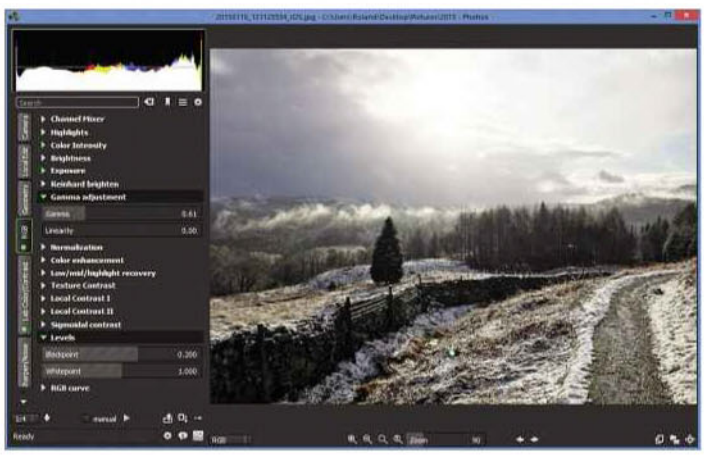
No matter how good online photo editors and mobile phone apps become, there will always be a need for PC-based software running on Windows. Apps rarely have the fine degree of control over the editing process that some people require and stubby fingers and small screens just aren't good enough. Pen-based tablets and phablets are slightly better in this respect because they offer a finer point of touch, but really the software is not up to the task anyway. Online photo editing apps have a problem with large and complex files, such as RAW images straight off the camera's sensor and multi-layered images that can grow to tens of megabytes.

PC-based photo editors are the most powerful and offer the best tools and functions, but they have their own drawbacks. A top end professional tool such as Photoshop, for example, is brilliant, but unaffordable to most people (though there are decent discounts for students). You either have to get your company to buy it for you because you need it for your job, or put up with monthly fees amounting to more than £100 a year just to use the software.

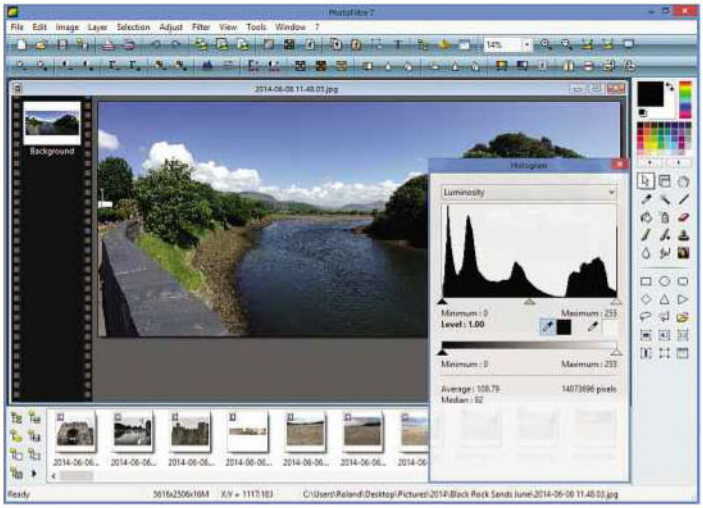
At the budget end of the photo editing market are some useful tools, and GIMP is an obvious one. It is excellent for a free tool and is a must-have photo editor that is like a poor man's Photoshop. It cannot match Adobe's software, but it has a pretty good go. Let's assume that you already have, or at least know about GIMP, and take a look at some of the other photo editing software you can get for free or very little money.

PhotoScape

PhotoScape (**photoscape.org**) combines many functions into one program and is akin to a Swiss Army Knife of photo editors. It can split images, combine them, animate GIFs, capture screens, batch process images and more. Go to the editor and there are useful tools for fixing flaws and enhancing images; for example, there are low, medium and high settings for auto-levels and auto-contrast. Some of the other tools are like that and have preset options too, but there are also advanced features like the colour, saturation and luminance curves.



Photivo is complicated, but is worth getting to know because of its excellent features



PhotoFiltre has a lot in common with GIMP, but adds its own functions too

There are many filter effects, including a variety of films, vignetting, antique photo, textures, artwork of various types, and so on. It sort-of has layers, in that you can load other photos and paste them into the image, rotate and resize them. Text can also be added, speech bubbles and shapes drawn, and so on. JPEG appears to be the only file format supported though.

Phoxo

If photo editors like Photoshop and GIMP are too complex and you want a simpler tool, try Phoxo (**phoxo.com/en**). Some might consider it under-powered, but for simple tasks it is okay. On the left hand is a palette of tools that includes three different selection tools, pen, paintbrush, eraser, clone, red-eye removal, and so on. These can be used to fix flaws in images, repair damage and so on.

> **“Apps rarely have the fine degree of control over the editing process that some people require”**

There are the usual brightness, contrast, hue, saturation, colour tone, blur, sharpen and other tools typical of photo editors. There are a few effects and filters that enable you to turn photos into different types of artwork (like oil paintings, for example), apply lens flare, sunshine and glass tiles. Most interesting is the custom filter creator, which is a five-by-five grid into which you enter numbers. The effect can be seen immediately and you can experiment and produce your own filters. There is also a collection of clip art and frames that can be added to the photo.

Photivo

Photivo (**photivo.org**) is a geek tool and is at the opposite end of the difficulty scale to Phoxo. It has an unusual interface and lots of obscure tools that might not mean anything to you. There is no denying that this is an excellent tool for enhancing photos though, nor that it has features not found in other software. For a start, it supports lots of RAW camera file formats, making it useful for people with quality digital cameras, but it also supports JPEG and other common file formats.

Just opening a file is a challenge, though, and it does not get any easier. It rewards perseverance, though. There are tabs down the left hand side that provide access to functions and these contain sub-functions in expandable sections – for example, the RGB tab contains 16 subsections with names like Reinhard Brighten, Sigmoidal Contrast, Normalisation and so on.

The best advice is to simply experiment. Many items are sliders, and you can drag them and see the effect.

PhotoFiltre 7

There are three versions of PhotoFiltre (**photofiltre-studio.com**) and version 6 is free and works with single layers, 7 is also free and supports multiple layers, and there is PhotoFiltre Studio X costing £24. Try version 7 first because it may be all you need. It certainly has a lot in it.

The menus and tool panel on the right are straightforward, but the two toolbars at the top of the screen are initially confusing because of the large number of icons that don't really convey much meaning. You get used to them after a while though. In terms of features and functions, it has almost everything you need and it is not unlike GIMP with a different interface. There are many adjustment tools, including advanced ones like gamma, histogram, levels, and so on. A collection of filters is available, such as oil paint, watercolour, pastels, sepia, twirl, ellipse, ripple and many more.

Fotor

Foto (**fotor.com**) is available on iOS, Android, Mac, Windows and as a Windows 8 app. It is a brilliant tool that is easy to use, yet is packed with great features for enhancing photographs. It supports a wide range of file formats, including RAW. The panel on the right provides access to the tools and they are so simple anyone can use them. For example, the top one is Scenes and you select backlit, cloudy, shade, sunset, night, sand/snow, or any one of others to automatically adjust the exposure, brightness, contrast and saturation.

The Adjust panel offers up tone, detail, white balance, vignette, highlights/shadows, and curve parameters. In each case there are simple sliders to drag to make adjustments, so it is easy to experiment to get the best settings. There are dozens of special effects organised into categories and you can click them to apply them and drag a slider to adjust the intensity. It is simple, yet powerful. **mm**

Fotor is a great tool for novices. It is easy to use and packed with tools and effects

Titans of Space is both educational and awe-inspiring

Top Ten VR Demos and Games

David Hayward dons his headset and checks out his favourite VR experiences

Virtual reality is the next big thing – again. Regardless of how critical you may be of it, there is an element of the fascinating about VR. We've had a DK1 Oculus Rift for a while now, and it's still one of the coolest experiences we like to show off to friends and family. We even had the guy who fitted the bathroom trying it out.

VR is set to hit the shelves in earnest early next year, with the launch of the Oculus Rift retail version, HTC Vive/Steam VR, Project Morpheus and a whole load of other examples. We're quite excited, to be honest, so we've come up with our personal top ten VR demos to have a look at those that brought forth lots of oohs, aahs and other such noises as we foolishly, to the amusement of those watching us, tried to touch the thing we were looking at.

1 Titans Of Space

One of our favourite VR experiences is this virtual tour of the solar system. Starting from Mercury and moving on through the planets, you get to sit inside a spaceship and view 360 degrees of heavenly wonder while taking in some educational information regarding each planet in turn.

It's a thoroughly engaging experience, and towards the end, when the demo starts to compare the sun with some really, really big stars rendered at 1:1,000,000 scale, you begin to realise just how small we are.

2 Lava Inc And Helix

Rollercoasters are one of the most used VR demos we've seen. There a loads of them, taking you through space, a mediaeval castle, even a representation of hell itself.

Lava Inc. and Helix are just examples from a Dutch team of VR developers, which take you on a nauseating thrill ride through various terrains. If motion sickness doesn't affect you, then head on over to **goo.gl/P2xfCv** and take a look at the demos on offer. Otherwise a bucket next to you might be handy.

3 Deep Echo

Deep Echo has you commanding a deep sea submersible, 4,000 feet below in the inky abyss to find the blackbox recorder of a doomed ship.

It's an immensely graphical experience, and if you put a set of good headphones on, it feels about as realistic as you could ever hope for. There are also moments of panic, as the glass on the sub starts to crack due to the immense pressures outside. Combined with the wailing of the hull alarms, the sound of groaning metal and deep booming noises from something striking the outer hull, it's quite amazing.

4 Virtual Cinema 3D

Virtual Cinema allows you to play any movie file from your PC, while you sit inside a realistic cinema.

You can look around, get up and change seats, even look at the projection hole in the wall. It's a great way to watch a movie, and it's significantly cheaper than a trip to a real cinema.

5 Private Eye

Much like the Cary Grant film, Rear Window, Private Eye has you with a pair of binoculars and nursing a leg in plaster.

However, a killer will strike at 10 O'clock, so can you solve the mystery before he takes out his next target? It's a great VR game and one we thoroughly enjoyed.

6 Museum Of The Microstar

This is another virtual tour, of sorts, where you get to walk around a futuristic museum and take in the exhibits while a small, controlled star burns in the centre.

Deep Echo: the claustrophobic feel of miles underwater is far too realistic

Dreadhalls is scary. Very scary

Is piloting an Xwing Fighter the ultimate in VR experiences?

It's visually splendid, and the sounds from the walking along the bare metal platforms to the low hum of the machinery all make for an epic VR experience. Thankfully, if you fall into the star reactor you get to come back to life again.

7 Dreadhalls

This is one of the best VR games currently available. It has you wandering the halls of a labyrinth trying to find the exit. However, a menagerie of terrible beasts stalks the hallways, and should you be seen by any of them – well, let's just say it's best you keep to the shadows.

It's a horror survival game with plenty of atmosphere and a dark, oppressing feel. If you don't mind jumping out of your skin in front of everyone, it's one to try.

8 War Thunder

War Thunder is a free-to-play air combat MMO, where you pilot a range of classic aircraft against other players from around the world in a variety of terrains and maps.

The VR side of this is simply amazing. Put a pair of headphones on, and experience what it's like flying a Spitfire or B52 Bomber. Incredible.

Honourable Mentions

Here are a few more we missed out from the main list, but which are still worth looking into if you own a VR headset of some description.

Elite: Dangerous – One of the most fantastic games of the year allows you to totally immerse yourself in the galaxy. You'll be in awe as you pass under a space station, looking up at the hanger and taking in the glory of the life-sized planet it's orbiting.
Surgeon Simulator – Another popular game and one where you can dig your hands into a virtual person's inside parts while wearing a headset.
The Apollo 11 VR Experience – Ever wondered what it's like during lift-off? Well, now you can virtually strap yourself into the top of a 400ft rocket while the mighty Saturn V boosters launch you into orbit.
AirDrift – AirDrift is a flying simulator where you have to pass through hoops while controlling the flying using your head. It does bring on moments of intense sea-sickness, but it's fun nonetheless.

9 AaaaaAAaaaAAAaaAAAAaAAAAA!!! For the Awesome

Despite the title, this £6.99 game from Steam is actually quite brilliant. It has you base jumping from a selection of increasingly ludicrous locations while trying to collect bonuses and not colliding with an obstacle.

The jump sites range from mountains to the moons of Mars, and you drop at improbable speeds. It can get quite nauseating, but it's immense fun.

10 Star Wars: The Battle of Endor

The last game/demo on this list is by far one of the best VR experiments available. We have a lot of love for the old DOS Xwing and Tie Fighter games, so being able to sit in the cockpit of an XWing Fighter while going up against the second Death Star is the stuff of dreams.

You'll face swarms of Tie Fighters while Star Destroyers lie in wait and bombarding your capital craft with heavy laser fire. The screen is filled with red and green laser blasts, and in low orbit over the planet Endor is the Death Star itself.

You can opt for a number of missions, such as taking out the Ties, disabling the SSD Executor, destroying the Death Star main reactor and escaping the Death Star. All are amazing, and bring out the best in VR.

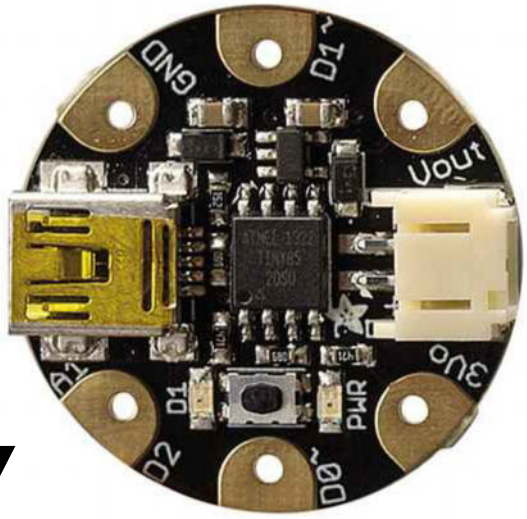
Better Than The Real World

That's just ten of our favourite VR examples we've been playing around with over the last few months. Needless to say, there are tons more worth having a go at.

While VR never made it out of the starting gate the last time around, it certainly looks like it may have a pretty good chance this time of becoming the next logical step for gaming. We can only imagine how it'll be in a couple of years' time when the technology is vastly improved and established.

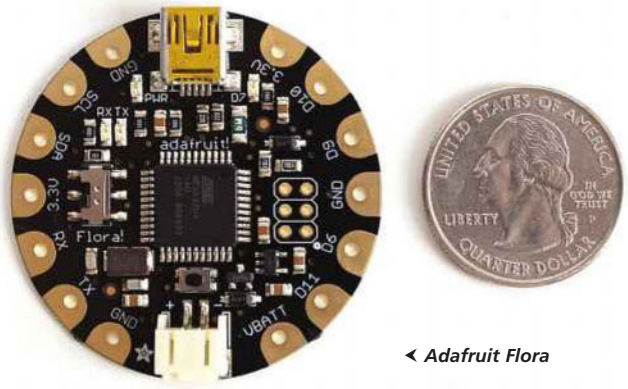
For example, can you imagine a 4K game like No Man's Sky on VR? Or how about something like Skype, but with the person you're contacting actually standing in front of you? Of course, Microsoft's HoloLens may put VR out of business before it even gets started. Who knows, but one thing's for sure: we'll be there wearing silly glasses, helmets and everything else needed to immerse ourselves in an open VR universe. **mm**

NeoPixel watch



Adafruit Gemma

Smart DIY Wearables



Adafruit Flora

David Briddock reveals how building smart wearable tech can be cheap and fun

Smartwatches, fitness bands and other wearable products are all the rage at the moment. Yet there's a lot of fun to be had fabricating your own smart wearable, so it's not surprising to discover there's already a large community of makers, hackers, crafters, artists, designers and engineers doing just that – what sort of hardware platform is suitable for a wearable project?

Some have opted for the ever popular Raspberry Pi, but you'll need big pockets to house the Pi board, extra components, battery and associated wiring, while fashioning some sort of external attachment arrangement, such as strapping it to your arm, isn't exactly an elegant solution.

A more viable alternative is one of the range of miniature boards ideally suited to the DIY wearable enthusiast; boards that have more than enough computing power, useful built-in functionality, flexible connectivity options and battery-friendly power demands to perform a range of tasks. So let's take a look at a few of the most popular options and see how they compare.

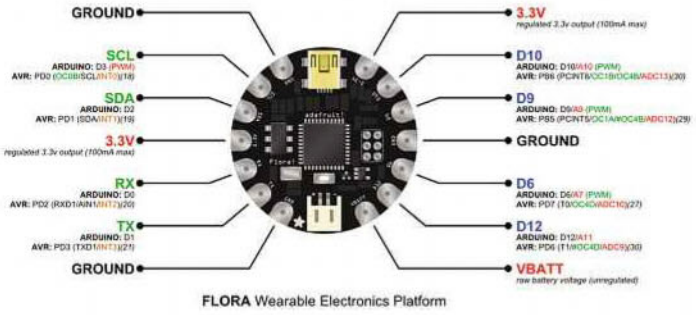
Adafruit Flora

As you might expect from it's full name, the Adafruit Flora Wearable Electronic platform is an ideal starting point for a wearable construction journey. It's small dimensions – only 45mm in diameter – doesn't mean it's lacking in capability. It's built around the Arduino-compatible Atmega32u4 chip, the same one found in Adafruit's popular Atmega32u4 breakout board (**adafruit.com/products/296**).

With its on-board USB HIB support you can emulate a mouse, keyboard or MIDI controller and it's a straightforward matter to make a device-to-device connection. As for power, the schottky-diode-protected JST connection supports battery packs from 3.5 volts right up to 16 volts. Alkaline, rechargeable NiMh/NiCad, LiIon/LiPoly or LiFe Power batteries all work fine.

The clever design, which provides no less than 14 pierced contact pads for garment attachment and electrical connections, means it's easy to attach the Flora to a range of clothing and bags. All these connections are clearly labeled, with eight dedicated I/O pins to ensure a flexible range of input and output signal possibilities.

If you want to take out even more of the work, you can even buy a ready-to-go wearable kit **(adafruit.com/products/1285**) with sewable connective thread (see boxout), various needles, sewable switches, candle-flicker LEDs, and CR2032 watch-type batteries with sewable battery holders.



Adafruit Flora petals

Flora First Steps

As we mentioned earlier, Flora is designed to be beginner-friendly. Even connecting a battery the wrong way won't cause damage thanks to a polarised connector and protection diodes. And an on-board regulator means attaching a 9V battery won't end in tears either.

With it's built-in USB support there's no need for special cables or other programming hardware. You simply need to plug it in to your PC's USB port.

Flora projects can incorporate just about any type of sensor, for example colour identification, pressure, motion and even GPS tracking (**learn.adafruit.com/flora-wearable-gps**). To start your wearable journey try one of Adafruit's excellent hands-on tutorials (**learn.adafruit.com**). One will have your Flora blinking its onboard LED in no time, while another shows how to control a string of external LEDs. After that you can move on to the Smart Pixels tutorial (**learn.adafruit.com/flora-rgb-smart-pixels)**.

Or how about a custom LED watch? One strategy is to incorporate a NeoPixel Ring, with 16 ultra bright NeoPixels LEDs (see boxout), which can be programmed to indicate the current time. A leather strap can host the circuit and hide the battery. To discover more visit learn.**adafruit.com/flora-geo-watch**.

Adafruit Gemma

Conceptually the Gemma board is a bite-sized version of Flora. The tiny wearable platform is only 28mm in diameter and just 7mm thin, so it's perfectly suited to super-discreet wearable projects.

Powered by a 8MHz ATtiny85 processor it has 8K of flash, 512 bytes of SRAM, 512 bytes of EEPROM, five input/output pins, built-in data-logging and a choice of internal or external active antennas. Yet it needs only 9mA of current to run.

LilyPad Development Board

Adafruit NeoPixels

Incorporating multiple LEDs into your maker project can quickly lead to a wiring nightmare. It also complicates the coding side of things.

The NeoPixel (officially the WS2812 Integrated Light Source) is Adafruit's solution for a simple, scalable and affordable full-colour LEDs, and they are incredibly bright LEDs too.

Available in red, green and blue these LEDs are integrated onto a tiny surface-mounted package, which includes a driver chip. Controlled through a single wire these NeoPixels can be used individually, chained into longer strings or assembled into other interesting form-factors.

There's a full description of Neo Pixels and maker best practices at **goo.gl/uwlddj**.

NeoPixel LEDs

The latest Gemma (version 2) has a micro-B USB connector, plus a green LED to confirm a connected power supply and a red LED for input/output traffic pin one. And there's even a minute reset button for entering the boot-loader or restarting the program.

The smaller design means only three of the petals/pads are assigned to input/output duties, as opposed to Flora's eight, but once again they're clearly labeled and just as easy to use.

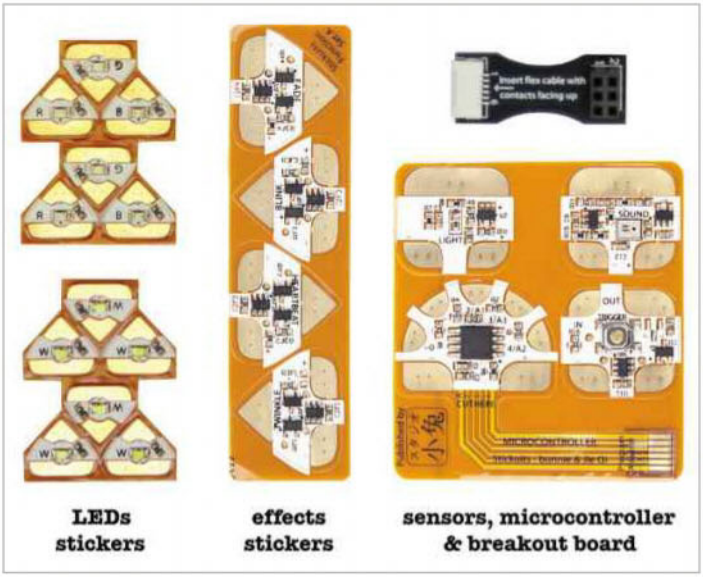
There's standard I2C compliant capability and you can program Gemma using the Arduino IDE. However, be aware that Gemma isn't quite 100% Arduino-compatible.

LilyPad Boards

Despite its impressive range, Adafruit doesn't have the monopoly on flower-like wearable technology. One alternative is the LilyPad range, based on a wearable e-textile technology developed by Dr Leah Buechley with support from SparkFun (**sparkfun.com**). In fact, SparkFun donates a small portion of each LilyPad sale to Dr Leah Buechley's work to support the platform development and e-textile education initiatives, while also ensuring the Arduino LLC can fund maker-oriented coding tools.

On-board a LilyPad there's an 8-bit ATmega328 microprocessor with 32KB ISP flash memory, 23 general purpose input/output lines, programmable serial communication and a six-channel 10-bit analogue/digital converter. It operates off an 1.8 to 5.5 volt supply and is controllable through Arduino software (**arduino.cc**), thanks to its Arduino bootloader.

Large connecting petals/pads encourage creativity and also help with garment installation. Plus there's a family of input, output, power and sensor boards. SparkFun even suggest a LilyPad is washable.



▲ *Circuit Stickers*

LEDs are an important aspect of any maker project. They indicate power levels, switch settings or just help circuit design debugging. LilyPad's custom LED boards simplify the construction process with their large anode (+) and cathode (-) petals. And a current limiting resistor ensures you won't burn out your LEDs.

One of the easiest ways to experiment is with the ProtoSnap LilyPad Development Board (**sparkfun.com/products/11262**). In addition to a LilyPad board there's buttons, switches, LED, sensors, a buzzer, conductive thread, needles and a Lithium Polymer battery.

LilyTiny

SparkFun also sell a miniature version of the LilyPad board. Called the LilyTiny it's designed to be a fun introductory kit. In particular it simplifies the construction of a twinkling LED projects without any have to write a single line of code. This is possible as the on-board ATtiny microprocessor is supplemented by pre-programmed LED control software. Connect a LilyTiny to four LEDs and watch each one behave in a different manner. The first blinks on and off, the second flashes in a heartbeat-like pattern, the third has a breathing-like fade, while the fourth performs a random fade (**sparkfun.com/tutorials/390**). The entire circuit is powered by a CR2032 coin cell battery – and it's still possible to re-program the LilyTiny via the rear-mounted ICSP programming connectors.

Conductive Thread

Wiring up a wearable project is made much easier with conductive thread. It carries a current just like a standard piece of wire, yet is fine enough to sow with, and electrical connections can be made without soldering. There are two main thread types, namely silver-coated and stainless steel.

The resistance of silver-coated threads varies quite a bit, so it's a good idea to check the resistance where long lengths are required. Also, as this type of thread has a nylon core it's not able to withstand soldering temperatures. In contrast stainless steel threads are 100% stainless steel and exhibit reliably low resistance levels (about 90 Ohms per meter). However, they are prone to twisting, which makes sowing a little trickier, and while soldering is a possibility it's not straightforward.

Microsoft Circuit Stickers

Circuit Stickers encourage smart device fabrication through the incredibly simple construction process of peel-and-stick transfers. Originating out of a Microsoft Research project, circuit stickers can be applied to any sticker-friendly surface including paper, cardboard, plastics, ceramics and fabrics.

Many popular electronic components are available; buttons, multi-colour LEDs and sensors for light, sound and touch. To build smart, interactive projects there's a tiny ATtiny85 microcontroller sticker, which can be re-programmed to deliver customised functionality.

Individual stickers are electrically connected using sticky copper tape, and a completed circuit design can either be powered from a small battery or hard-wired to a microcontroller board or PC.

To empower designers, artists, engineers, kids, students and teachers to build Circuit Sticker projects Jie Qi at MIT and team member Bunnie Huang have launched sets of stickers and sticker kits (**goo.gl/Ex5Qok**). Their web page also has links to step-by-step tutorials and printable circuit design templates, such as how to control an array of LEDs using the microcontroller sticker (**goo.gl/qv5nC3**).

Creative Inspiration

Wearable projects are all about creativity. There are no rules and no conventions, so just let those creative juices flow; it's a huge untapped marketplace, so your experiments might end up leading to a commercial product. Obviously you won't be able to create a replica Apple Watch, Microsoft Band, Jawbone or Misfit Shine, but you can build a bespoke gadget that's has a unique look and functionality.

How about designing your own gaming pad? It doesn't have to be a hard plastic affair. Instead your starting point could be a soft toy or cushion. Alternatively you could create a range of bionic accessories. Say a smart glove with sensors and/or switches that acts like a mouse, game controller or musical instrument; all with a tap of your finger.

If you love to walk, hike, jog or cycle how about a fitness tracker. Step data can be combined with GPS route mapping to calculate total distance, average speed and other statistics. SparkFun even do a Muscle Sensor kit (**sparkfun.com/products/13027**) that uses electromyography (EMG) to detect muscle activity.

And if cycling safety is a concern how about a high visibility project using Adafruit's super bright NeoPixel LEDs. Attach it to a backpack or sow it directly onto a cycling jacket. You could even add switchable turning indicators.

Whatever you project make sure it's fun – and we'd love to know what you created. **mm**

▲ *Conductive Thread LED kit*

Top 5 Computing Distractions

You know you should be working, but these things just won't let you

1 Games

Computer games, by their nature, are generally a bit of a waste of time; they exist to distract you from your boredom. But they can also drag you away from your work too. Of course, if you work in an office, then your employer might have made it impossible for you to install software on your workplace computer. However, if they haven't disabled Flash in your web browser or blocked gaming sites, you can still find plenty of ways to while away your time at sites like Miniclip.com. If only someone would pay you to play Tetris...

2 Facebook

For all its faults, it's hard to deny how addictive Facebook can be. Heard a funny story at work? Then you have to tell all your 'friends' about it. Just imagine how many Likes you'll get! Lovely, ego-boosting Likes... But it's not all just about self-indulgence. It's also about seeing what other people are doing, while you're stuck filing order forms or something tedious like that. Maybe someone has posted something funny that will pick you up. Or maybe someone you secretly don't really like is having a bad day, which will also give you a lift. Whatever the case, this siren is calling you, and it really doesn't want you to get anything done.

3 Twitter

Sometimes, telling people you know (however vaguely) stuff about your life just isn't good enough. Sometimes, you just amaze yourself so much that the whole world should know about it. At those times, you need Twitter. And not only do you get to share the minutiae of your life with potentially millions of people, you can also directly connect with your heroes. Yes, where else can you find the runner-up of Big Brother series 3 repeating something you've written? Nowhere! And the character limit is perfect, because why would you ever want to say something longer than 140 characters?

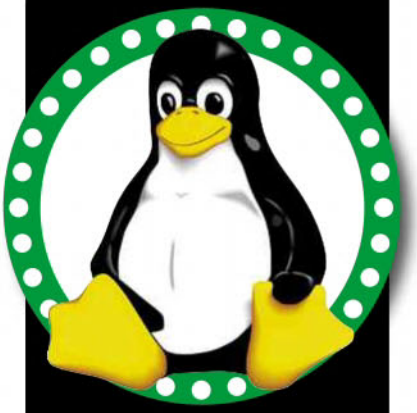
4 Wikipedia

Although it doesn't have the greatest reputation, Wikipedia is mostly accurate, with the majority of mistakes being of the deliberate kind. It's not good enough for journalists or students to rely on, but for the average Joe, it's a quick and easy way to learn about absolutely anything, whether it be World War II, rare fish, hair loss or anything in between. But it's far too easy to start following links in articles and find you've wasted the last two hours or so – and your boss still wants that report, regardless of how much you now know about the history of Morris dancing.

5 Quizzes

If you were a fruit, which one would you be? That's the kind of thing you can find the answer to if you just complete one of the many short quizzes found on the internet, made up of completely arbitrary and inane questions. These terrible, terrible questionnaires get shared around social networks, and more and more of your acquaintances enlighten you as to which character from Lord or the Rings they are. They're pointless, annoying, stupid and, for some reason, we can't stop doing them.

And just so you know, we'd be a mango.



E.T. OS

The search for extra-terrestrial operating systems

David Hayward has been using Linux since Red Hat 2.0 in schools, businesses and at home, which either makes him very knowledgeable or a glutton for extreme punishment

While it's certainly good looking at the latest distros, desktop environments and window managers, it can get a little samey after a while. It's usually around that time that I tend to go off the straight and narrow path and try to look for something a little different when it comes to Linux.

Usually it ends up with some story on how Linux is being used as the operating system of choice for some council, business or even a different country. However, I was recently reading about Nasa chief scientist Ellen Stofan, and her theories of humanity finally meeting up with an alien civilisation and the complexities that will naturally occur between our two species.

Stofan mentioned, during a recent discussion regarding Nasa's search for habitable planets, "I think we're going to have strong indications of life beyond Earth within a decade and I think we're going to have definitive evidence within 20 to 30 years." Although much of the discussion focused on life being non-intelligent species, such as worms under the frozen seas of Ganymede, there were snippets that talked of an interaction between intelligent species.

This got me thinking: what would an intelligent alien's operating system look like, and could we ever hope to communicate with it?

Interstellar Communication

There's an interesting book available called Archaeology, Anthropology and Interstellar Communication, by Nasa no less, which looks at how humanity would 'talk' to an alien species using our current levels of technology.

As it happens, the cross cultural understanding between different intelligent species will be conducted primarily between the computer and operating systems of each race. So as John Traphagan, one of the contributors, says talks the limitations of common language and a walled-garden approach to an operating system will have a limiting effect when talking to an alien race.

It's my understanding then, that a freely open operating system won't have the boundaries that Windows or Apple OSs inflict on the user. Linux, then, could be the OS of choice when it comes to talking with an alien civilisation.

There's a second element I've thought of too, where Linux could be a good ambassador for humanity to an alien encounter. If they, the aliens, were to analyse a Linux OS, then they'd see the collaboration between different people in different countries from all over the world. This noble fusion of minds, regardless of beliefs, colour and so on could be a feather in humanity's cap and persuade the alien race that we can work together.

Of course, should the alien race decide to wipe us out with its far more powerful and formidable weapons, we can always count on an Apple laptop, 90s virus, Jeff Goldblum and a blooming big nuclear weapon.

Alternatively, we could well be living in the Rare Earth Hypothesis, in which case humanity is the only intelligent race in the entire universe, and the selfie stick is the pinnacle of our civilisation. Now there's a depressing thought to finish on.

Can we use Linux to talk to aliens?

Lost In Music

Craig Grannell wonders why so many tech writers appear to be caught in a trap when it comes to critiquing Apple Music

At WWDC 2015, the Apple Music section was painful. Seemingly lasting for days, it found several people on stage trying – and largely failing – to explain precisely what Apple Music was and what it would do; nonetheless, there was plenty of the usual Apple bragging, with claims about how the service would rethink music and be totally amazing.

Now Apple Music is here, everything's a bit clearer. It's essentially Apple's take on Spotify, with a radio station and a sub-par Twitter rip-off bolted on, a ton of human-created playlists and a trainable algorithmic discovery engine called 'For You'. That doesn't sound especially exciting nor terribly appealing, and first impressions really aren't promising. The on-boarding process is dreadful, being almost comically bad on an iPhone as you prod little red circles to give Apple Music some insight into your musical tastes. (And it seemed a little *too* eager to have me select Paula Abdul, for some reason.) Also, the interface is sometimes messy and confusing elsewhere, and notably different from what you perhaps expect after years of using Spotify.

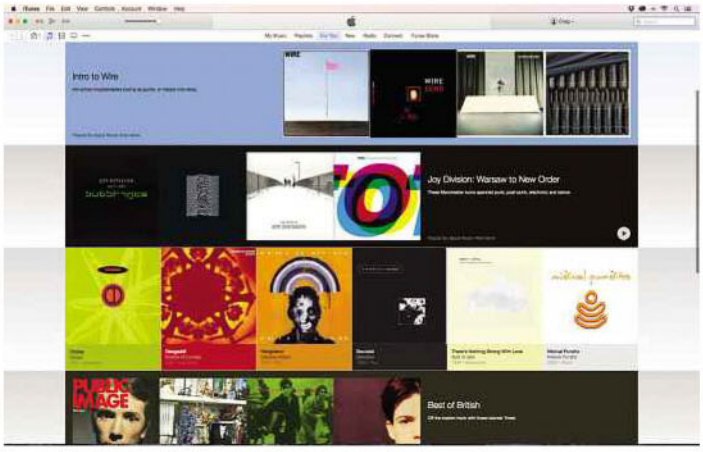
It's pretty obvious, though, that this is the point where a lot of tech writers stopped using Apple Music and started furiously mashing keyboards, in order to slam Apple's 'latest failure'. Reading through the coverage was very telling. Some abandoned the service after mere hours, declaring it to be mediocre, which seems an oddly concrete opinion after so short a time. Others complained about the playlists, primarily because they don't work in the same way as those from other services, preferring you to delve into a band or more descriptive container, rather than the generic and more typical 'I'm feeling fluffy' or 'GRRR'.

The thing is, so eager are people these days to slam Apple and thereby appear contrarian and right-on when it comes to tech writing that they don't pause to recognise when the company's done something that isn't revolutionary, but that's bloody good anyway. And that's Apple Music all over. Yes, there are superfluous bits (the Connect social network is like Twitter bereft of activity and your friends), there are bugs (notably some Match subscribers having problems with DRM), and the interface needs some serious work – but it gets the important things right.

During my days with Apple Music, my home screen in iTunes has shifted from 'My Music' to 'For You'. Every time I click on that tab, I'm presented with new things to listen to, broadly in line with my tastes. Some are safe choices, but others are further afield. Frequently, an album's lurking there that I've always meant to get around to but never have. The system feels smart, in a manner that its rivals rarely are.

And then there's everything else. Beats 1 might not be especially innovative – it's a traditional radio station, after all – but it showcases the humanity at the heart of Apple Music. The same goes for the playlists. Check out those based on your favourite artists, and you quickly come to the conclusion Apple Music 'gets' them and, by extension, you.

That probably all sounds a bit lofty, and given that I write this column and own a selection of Apple kit, it might come off as the delusional ravings of an Apple fan-boy. In reality, I'm in fact totally surprised and almost entirely converted. I'd expected to be slamming Apple Music myself, given its terrible introduction. Instead, I'm hugely enjoying a streaming music service that's mere days old, wondering how on earth rivals are going to respond.



A few days in and 'For You' is serving up Wire, Boards of Canada and Slowdive. Yes, please!

Craig Grannell is a writer, designer, occasional musician and permanent loudmouth. He's owned Macs since 1996, when Apple was facing certain doom, and is therefore pleasantly surprised by its current success. Find **Craig** on Twitter at **@craiggrannell**

Nexus 4.5

As their prices fall, Ian McGurren reconsiders Google's latest

Ian is a professional IT analyst, a semi-professional writer and a pretty amateur electronic musician. He likes gadgetry and loves making gadgets do things they were never designed to do

It's safe to say that of all Google's Nexus products, 2014's Nexus 6 phone and Nexus 9 tablet weren't as warmly received as Mountain View may have hoped. Some of this was squarely blamed on their premium prices, especially after the popularity of its 2013 Nexus 5 and Nexus 7 line was down to great tech at a very affordable price. People were baffled as to why the 6 and 9 both were over £300, closer to £400. Now, in lieu of the launch of the 2015 range in Q4, Google has recently cut the prices of the devices, though sadly they've returned to nearly the same price. But with rumours that they are no longer being produced, the time for cuts is coming, so should they feature higher on your lists when considering new tech?

Nexus 6

Recently the Nexus 6 was in the Google Store at £304, (£399 normally). In terms of how it sits with other handsets, things have changed in the past (nearly) year: it's the best value premium phablet if you want to buy SIM-free and from a shop, but there's been something of an explosion in cheap, large handsets in both the budget market and the discontinued market.

For those on a tight budget, large 5" to 5.5" handsets are aplenty, led by none other than the perennial favourite, the Moto G 2014. Others have got in on the act, though, with even Windows Mobile offering the Lumia 535 for under £90. Consumers are also more willing to embrace Chinese smartphones, finding the lure of Android Lollipop, a 5.5" screen and slick design for £100 tough to ignore.

While the Nexus 6 still holds its own against the likes of the Samsung Galaxy Note 4, with premium phablets like the LG G3 now regularly available for around £210, justifying that extra £90 isn't so easy, especially as it's still – and always will be – a very big handset. At the end of the day, the Nexus 6 is mainly popular with those who specifically want a Nexus device, and it's them who will be happy here. But against the competition, even the cut may not be enough to push the 6 back onto consumers' lists.

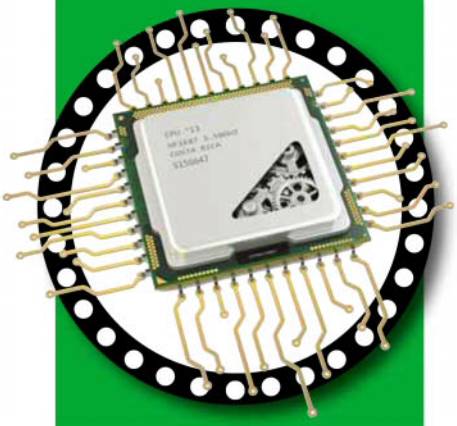
Nexus 9

Even better value, the Nexus 9 was showing in both Amazon and Argos for around £200, some £100-120 off the retail prices at launch. However, while the Nexus 6 was mostly met with a positive response on release, the arrival of the Nexus 9 wasn't heralded in quite the same light. On paper it looked a dream device (the high-spec 64-bit Nvidia K1 CPU, the 'retina' level screen in a rare 4:3 format, the first to run Android 5.0 Lollipop, all built by HTC), but in practice the quality and experience fell below the expected standard. Users complained about the creaky build, the screen's light leaking from the side and, like the Nexus 6, the sluggish OS. Has the price cut negated these issues?

Unlike the Nexus 6, the Nexus 9's place in the tablet market is still unique. It's the most capable K1 device, and one of the few with a 4:3 screen, a bonus for those switching from the iPad. With a heavily reduced price, the Nexus 9 represents good value for money, especially as some of the issues have been addressed in Android updates.

Though they are possibly end-of-life, both devices are now entering the kind of price range where they're worth a second look. If the Nexus 6's 6" screen USP still appeals to you, it's now cheaper. If it doesn't, then really there are still others to consider first. However, if you're after a capable and solid Android tablet, the Nexus 9 at around £200 is excellent value and unique in many ways, with little comparable competition. Just don't expect HTC's usual quality...

Faster, Happier, More Productive



Andrew Unsworth becomes world's best husband after fitting SSD and RAM in a sluggish laptop

Those of you who regularly read this column will know that I recently invested in an SSD for a painfully sluggish laptop. I bought a Samsung 850 EVO, which is fast and good value, especially as it comes with disk cloning and management software. I had to buy a SilverStone SST-EP02 USB3-to-SATA adaptor to attach the Samsung SSD to the laptop in order to clone the mechanical hard disk, but I've needed such an adaptor for a while and didn't mind forking out for one. The Samsung Data Migration disk cloning tool performed brilliantly, and I could apply the much smaller capacity C:\ partition of the mechanical hard drive to the SSD's full capacity.

The speed advantage of the SSD was clear immediately, with my wife overjoyed that a PowerPoint presentation that had taken minutes to open now did so in a few seconds.

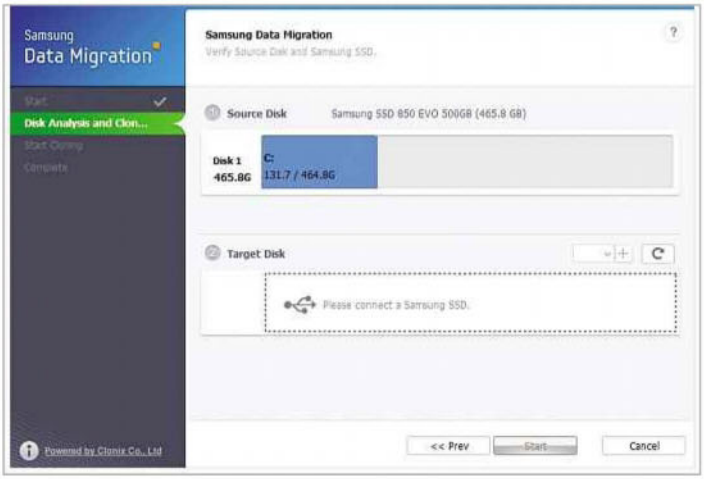
Once the SSD was fitted I waited a couple of weeks until payday before taking the plunge and buying some RAM, although part of the reason for the delay was not being certain of the maximum RAM capacity of the laptop. The manufacturer's website says it's 8GB, but when I entered the model into Crucial's Advisor Tool on the RAM manufacturer's website (**uk.crucial.com**), the tool said the maximum RAM capacity is 16GB. A Google search produced forum posts that had some posters saying the laptop did support 16GB of RAM and some saying it didn't. In the end, I chose to trust Crucial's website and ordered 16GB of SO-DIMM RAM.

> **"Further your investment instead of buying a new laptop"**

8GB probably would've been sufficient, but I wanted the extra capacity that 16GB provides given that my wife often works with videos, photos and has many applications open at the same time. 8GB would probably be sufficient now, but I wanted to make sure there was enough capacity for the future.

Fitting the RAM was the work of moments, and once it was installed I turned on the laptop. It seemed like an eternity before the BIOS splash screen appeared, but it eventually did, and within a wonderfully short space of time I was at the Windows login screen. The laptop does indeed recognise and use the full 16GB of RAM, vindicating Crucial's compatibility claim.

As I said in my previous article, it was much more economical and less wasteful to install an SSD and RAM than to spend close to a grand on a new laptop with an SSD and RAM capacity to match those I'd installed. We certainly couldn't have bought a laptop as good or powerful as this one is now for the roughly £235 it cost me to install the upgrades. If your laptop is beginning to creak with the pressure of modern software, it's well worth seeing if it's possible to upgrade it in a similar way and further your investment instead of buying a new laptop and throwing your old one away.



Samsung's Data Migration tool makes upgrading a laptop's hard disk to an SSD wonderfully simple

Andrew Unsworth has been writing about technology for several years, he's handy with a spanner, and his handshaking skills are second to none

Ryan Lambie has loved videogames since he first stared up in awe at a *Galaxian* arcade cabinet in his local chip shop. 28 years on, Ryan writes about gaming for Micro Mart. He's still addicted to chips and still useless at *Galaxian*

Retro Robots

Platinum Games applies its talent for addictive third-person brawlers to Transformers: Devastation. Note the nostalgia-inducing G1 robots

This week, Ryan checks out the forthcoming brawler based on Transformers, and takes a look at Trion's voxel-based MMO, Trove...

Plug & Play

Hasbro's hit Transformers toys haven't exactly had a glittering track record when it comes to videogames. The franchise got off to an iffy start way back in the mid-80s; *The Transformers*, programmed by Denton Designs and released by Ocean Software, was a so-so platformer marred by iffy controls. The Japan-only *Transformers: Mystery Of Convoy* (released for the Japanese Nintendo Entertainment System in 1986) was even worse.

Most subsequent games based on the transforming robots have received middling reviews at best, from the feeble *Beast Wars: Transformers* released in 1998 to 2007's *Transformers: The Game*, developed by Traveller's Tales. *Transformers Online* appeared in 2011 and vanished again a year later. *Transformers: Rise Of The Dark Spark* (2014) was treated with critical scorn.

The Transformers could, however, have found a vital ally in Platinum Games. At E3, the Japanese studio unveiled *Transformers: Devastation*, a third-person brawler threaded with a wide band of nostalgia. Featuring the original robot designs from 1980s – Optimus Prime, Megatron, Bumblebee and the like – *Devastation* is rendered in a cel-shaded style which makes it look quite a bit like the old animated television series.

Now, we'd ordinarily note a sound of caution as the uncannily accurate robots start punching and blasting each other on the streets of a deserted city. We've seen plenty of handsome-looking Transformers games in the past, and isn't the use of Generation One robots a cynical ploy to get 30-something gamers misty-eyed enough to ignore the ropey gameplay lurking beneath its charming exterior? What's promising about *Transformers: Devastation*, though, is the talent of the studio behind it. In the past; Platinum's made some spectacularly fun and anarchic action games, including *Bayonetta*, *Vanquish* and the bizarre Metal Gear spin-off, *Metal Gear Rising: Revengeance*.

From what we've seen so far, *Devastation* looks like a game made in the same hack-and-slash spirit of things like *Bayonetta* and *Revengeance*: it's all about precisely timed attacks and devastating combos. Some footage captured from a playable demo at E3 shows how quickly and smoothly the player can transform from robot to vehicle and back; Optimus Prime, for example, can use his speedier truck form to crash into enemies, shift into robot form and then deliver a killer blow with his fists or laser cannon.

The only black cloud on the horizon is that Platinum blackened its otherwise glowing track record with a game based on another children's franchise: last year's *The Legend Of Korra,* a less than brilliant fighting game. However, reactions so far suggest that Platinum's back on form with *Devastation*, which seems to have had quite a lot of money and care lavished on both its visuals and mechanics. Just about every major robot from the Transformers' early years seems to be present and correct, while voice actors like Frank Welker and Peter Cullen, who provided their voices for *The Transformers* TV series, are reprising their roles here.

There's every chance, then, that *Devastation* could be one of those rare things: a Transformers game with a great engine purring beneath the slick exterior.

Transformers: Devastation is out on the 6th October.

Online

Minecraft has a lot to answer for. With this once humble game now worth billions, other studios are getting in on its blocky, sandbox act; in June,

▲ *The voxel graphics and building might recall Minecraft, but Trion Worlds' Trove has more in common as its earlier MMO, Rift*

Lego Worlds emerged, an online game offering a strangely familiar blend of exploration, gathering and building. In early July, Square Enix announced *Dragon Quest Builders*, a PlayStation-only spin-off from its long-running RPG series. There's only one screenshot to accompany the announcement, but sure enough, it introduces a lush green world built almost entirely from little cubes.

Not to be outdone, MMO specialists Trion Worlds launched a new title called *Trove* on the 9th July. It too is set in a colourful world built entirely from voxels, and it too lets players create their own items, buildings and other objects.

In fairness, though, Trove is far from the straight *Minecraft* clone it might initially appear to be; while building things is a part of Trion's game, it's just as close in spirit to the studio's earlier MMOs like *Rift* or *Defiance*. Taking place in a single persistent world, it has levelling, classes, dungeons and quests, as well as a trading post where players can exchange or sell their items.

Players can also customise their characters, ride through the skies on dragons or sail off in a boat for a spot of sea fishing. It's a game with a playful, cuddly edge, for sure, but *Trove* also has plenty of sharp edged action; fighting monsters and collecting loot is as much a part of Trove as building, and newcomers may be slightly surprised at just how fast and vicious some of its enemies actually are.

Trion's spent two years putting *Trove* together, all based on an initial prototype it put together in just six weeks. In the run up to launch, the game's already started to build up the first shoots of a community; according to an interview with the website Venturebeat, *Trove*'s already amassed over 3,000 buildings and items created by its earliest users.

Trove is free to play, with the option to buy various class packs – unlocking different mounts, costumes and other items – for £15.49. Trion plan to add more features to the game in the future, too, including additional, enemies, a deeper player economy and PvP combat.

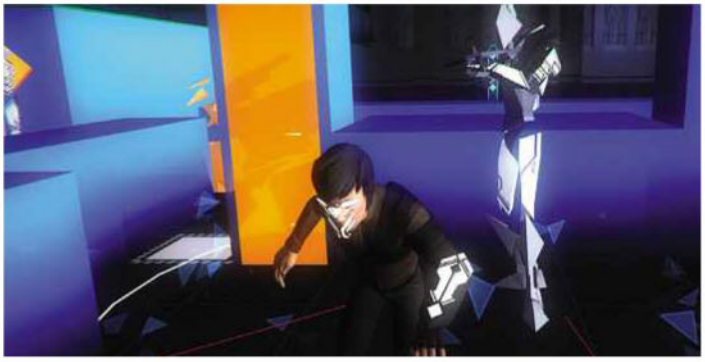
While *Trove* probably won't steal *Minecraft*'s multi-billion-dollar crown anytime soon, it's already garnered plenty of positive feedback, and like Trion's *Rift*, could soon cultivate a dedicated cult following. You can find out more at **www.trionworlds.com/trove**.

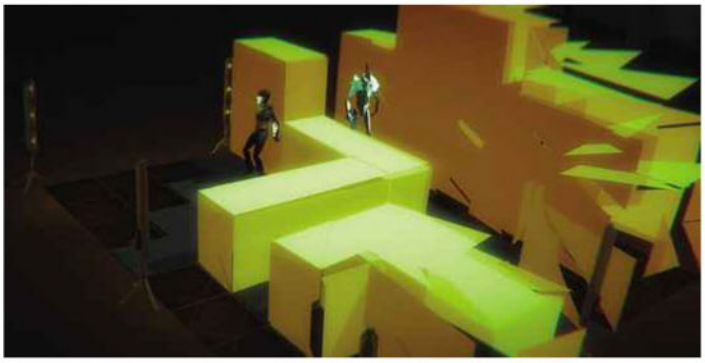
Incoming

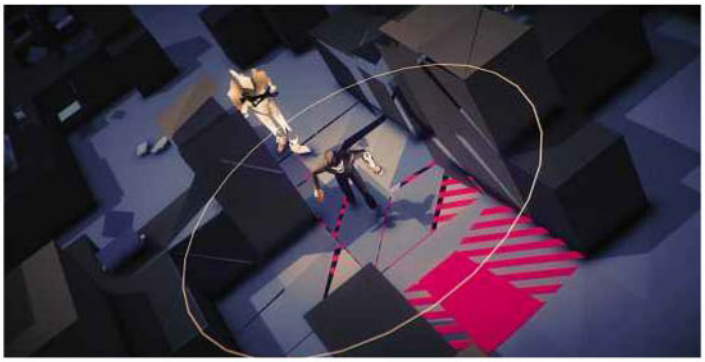
After the captivating *Thomas Was Alone*, Mike Bithell's next game was bound to be highly anticipated – and, finally, it's nearly here. The indie stealth game *Volume* seems a far more technically ambitious effort, yet *Volume*'s mechanics are also easily understood.

Viewed from a top-down perspective, the game presents you with a blocky maze of heavily guarded corridors and rooms. It's your job to misdirect the guards by making noises, thus drawing them away from the loot you're meant to steal. It's a twist on the kind of nervy gameplay pioneered by the *Metal Gear* series. The penalty for being detected is similarly deadly – your character is powerless to defend himself from the guards, and discovery will mean either a hasty retreat or a swift death.

Thomas Was Alone was marked out by its ingenious level design. If *Volume* follows suit, it could be another cracking title from the creator of what was arguably among the best indie games of 2012. Volume is out on the 18th August.







▲ *The creator of Thomas Was Alone returns with the indie stealth game, Volume. It sneaks onto PC on the 18th August*

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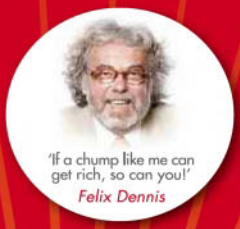

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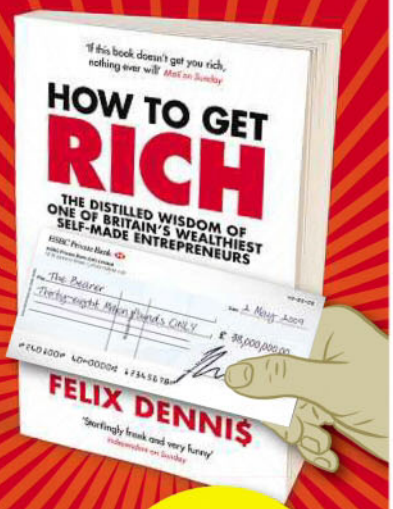

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Tel: Jeremy Gill (02089) 430683
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Kingston HyperX 2x2GB DDR2 1066MHz RAM. Tested and removed from a working environment. £45 inc Free Courier. Payment via PayPal.
Email: info@jmcomputing.info

2x 512MB PC3200 DDR400. Two sticks were removed from working system. £5, plus £1 P&P.
Tel: Alan (02084) 202322
Email: alan@asandco.co.uk

DDR2 memory sale. 2 x Nanua PC2 3700 256MB £6 pair, 2 x HP PC2 4200 256MB £7 pair, 4 x HP PC2 4200 512MB £10 pair or £18 for four.
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Email: pat4cars@aol.com

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DELL OPTIPLEX GX240 SFF. P4/1.6, 20GB hard Drive, 768MB RAM, CD-Rom, 10/100 network, Sound, Front USB, Clean install XP-pro, fully updated, works OK but slow by modern standards, £15.
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Tel: (01619) 501218
Email: jmbest2@sky.com

Toshiba C500D-B-11 laptop. Almost new cost £279 will accept *£150ono*
Tel: (01217) 535324

Intel 3930K processor. Used, but not overclocked. No box or fan. £220 ono. Will ship to UK address.
Tel: Tim (01623) 624509
Email tim.stirland@btinternet.com.

Amstrad PcW 9256 in good working order with software. Offers.
Tel: John Adams (02088) 641202
Email: meeching@uwclub.net

Asus P8Z68-v LX socket 1155 motherboard. Original box 1/0 cover user guide driver disk fitted core i3 2100 CPU 3-1GHz and 8GB PC1300 memory. No fan. Working fast and fine. £125 + free postage.
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Email: jmbest2@sky.com

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Email: pscarth@blueyonder.co.uk

400GB IDE drive 3.5 inch formatted ready for use. Only £20 plus £3 for p&p. I can load genuine XP Professional from Microsoft with genuine certificate of authenticity for an extra £10. Refurbished.
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Email: davethomas96@aol.com

Panasonic KX-P7105 mono laser duplex printer. Some toner left. Up to XP only – hence £25. Buyer will need to collect from N2, East Finchley
Tel: (02083) 431527
Email: pnnikiel@gmail.com

HARDWARE WANTED

Trying to breathe life back into an old machine? Why not submit a wanted ad and see if any of the thousands of computer enthusiasts who read the magazine each week have what you're looking for?

WANTED: PC Tower case (beige colour if possible) to rehome an Amiga A1200 vintage computer. The Amiga motherboard is H 410mm x L 190mm (H 16" x L 7.5"). PSU not an issue but if available 250 watt more than enough.
Tel: Bill (07742) 061569 or (02641) 769503.

WANTED: Fractal Design Define XL full tower case. R1 (original version) in black.
Tel: (01670) 860146
Email: mm@tectron.co.uk

WANTED: Working Dot Matrix Printer in Good Condition. Thanks!
Email: printer.20.odaily@spamgourmet.com

WANTED: Acorn computer either an A5000 or A7000. Also book on teaching yourself binary.
Tel: (07817) 861011
Email: Johnhaviland73@gmail.com

SOFTWARE FOR SALE

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Adobe Photoshop Elements and Premiere Elements 12 Full Version - Windows/Mac. Original Boxed CD with unused product key. £47.50
Tel: Ian (01932) 856971
Email: a2345@btinternet.com

PCB design software 127 layers, schematic entry, PCB entry, PCB to Gerber file converter, output to printer. £9.99
Tel: Nigel Wright (07967) 527693
Email: cresswellavenue@talktalk.net

Cyberlink PowerDVD 12 Standard. Runs under Windows 8, 7, Vista or XP. Original CD with unused product key £7.50
Tel: Ian (01932) 856971
Email: a2345@btinternet.com
Microsoft Office 2013. Original Software only £100.
Tel: Gordon (01314) 660205
E-mail: scobieg09@gmail.com

Sim City 2000. Boxed and original. Classic gaming. £15.
Tel: Gordon (01314) 660205
E-mail: scobieg09@gmail.com

Norton Family Premier 2.0. Runs under Windows 8, 7, Vista or XP, Original Symantec unused product key £15.
Tel: Ian (01932) 856971
Email: a2345@btinternet.com

Nuance Omnipage 18. OCR for Windows 8, 7, Vista or XP, Original CD with unused product key £25.
Tel: Ian (01932) 856971
Email: a2345@btinternet.com

Acronis True Image Home 2012. Bootable CD. Application runs under Windows 8, 7, Vista or XP. Original Acronis CD with unused product key £5.
Tel: Ian (01932) 856971
Email: a2345@btinternet.com

SOFTWARE WANTED

Wanted: I have a BCL 2.4g Wirless Gaming Mouse, Model: RF0P77 (3v 7ma) but no Drivers. Can someone help with a copy of the Original Drivers for this Wireless Mouse>??
cliffordevans603@btinternet.com

Wanted: Driver disc for Toshiba L30-11D PSL33E laptop. Laptop useless without drivers but only worth £40, so cannot pay a lot.
Tel: John Udall (01384) 824494
Email: john.udall@blueyonder.co.uk

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Please try to keep your queries brief and limit them to just one question per letter, simply so we can squeeze in as many as we can each week. Please include relevant technical information too.

Aaron

On Q

I've noticed a strange new drive appear on my machine, which is labelled Q in Computer. When I click on it I'm told that access is denied, and I cant' seem to remove it, either. I also saw that the drive has no data, and is listed as using 0 bytes of 0 bytes.

I have absolutely no idea what's going on here, and what this drive is, but I'd like to know, and if needed, how to remove it. Your advice would be welcome on this.

Chad

Although you didn't say if you've added any new programs recently, I suspect this may be the case, as your description leads me to deduce you may have tried some form of Microsoft's Office. I say this as there is a feature of recent editions of this package that has caused very similar symptoms for other users. In fact, it's not an actual problem, it's a matter of program design.

That's because the office suite uses 'Click-To-Run' (CTR) architecture in order to finction as planned. This is a kind of streaming/ virtualization technology that's designed to reduce the time it takes to download Office client products. A side effect of this is the addition of a new, virtual file system drive, one that even appears in Disk Management (where most virtual drives don't) – and is, I suspect, what you can see.

This drive is labelled as Q, and it cannot be changed. If Q isn't available, without adaptations, the installer will fail and you'll be asked to make the letter available in order to rectify the problem.

Therefore, there's nothing to worry about regarding the Q drive, as it's only a virtual tool for Office. However, if you really want to, you can remove it.

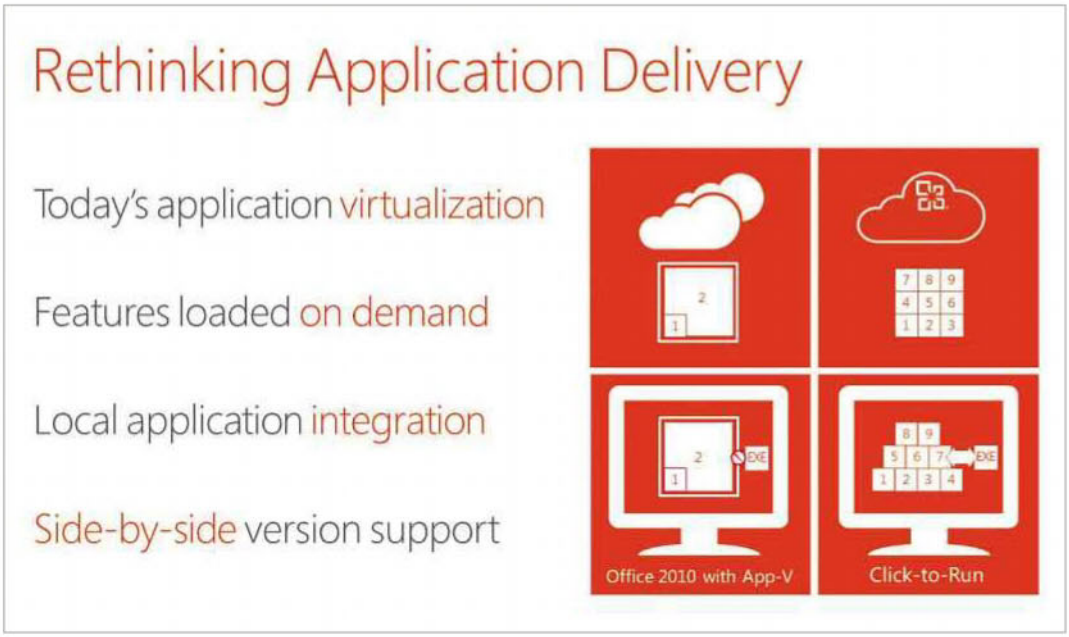
You should be able to remove this drive by either uninstalling Office, or at least removing the CTR functionality. This can be done in the usual way for most, via Control Panel, but problems have been experienced by some users who have had previous versions of Office installed. Whatever the reason, occasionally CTR isn't easy to remove, so there's a need to turn to the registry. As always, however, always back up your registry first before making any changes.

> **“It's not an actual problem, it's a matter of program design”**

Open this up by typing 'regedit' at the command prompt (you'll need admin rights to do this) and then navigate to 'HKEY_CLASSES_ROOT\Installer\Products' and expand it. Here you'll see some entries that begin with '00005' followed by many more digits and characters. Look at these entries and delete any folders that contain a ProductName value of 'Office 15 Click-to-Run Extensibility Component' that you come across.

Once this is done, it's a good idea to reboot to make sue any changes take effect. When you do, have a look and see if the drive is still there. If all has gone to plan, it won't remain. Be aware, however, that you'll not be able to use the Click-To-Run functions, so will lose the benefits it grants.

MS Office Click-To-Run can create a new, virtual drive on your PC, unbeknownst to the user



Drive Exorcism

Thank you for the detailed answer you gave to my question about the sudden appearance of a drive A:\ which was was similar but not identical to my existing C:\ drive. I have attempted to follow your instructions, but with no joy. First of all, contrary to what you prophesied, Drive A:\ does appear in Drive Management, but I went ahead with the rest of your instructions anyway.

The command prompt defaults to 'C:\users\James>', and I cannot seem to take it back to just C:\ – with a vague memory of using DOS years ago, I tried typing "..", but it didn't recognise the command. I tried typing C:\, but it said that command was not recognized. Anyway, I typed "subst" at that prompt, and it simply reverted to C:\users\James. It did not produce a list of drive paths. So I went the whole hog as per your instructions, and typed "c:\subst a: /d, and again was told '"c:\subst' is not recognized as an internal or external command, operable program or batch file'.

Needless to say, at no point did I see a result anything like 'A:\ => C:\UsersJames\AppData\Local\Temp'.

I attach a screenshot of my clumsy work at the command prompt, and one showing Drive A:\ in Drive Management.

Sorry to keep bothering you, but do you have any idea what I should do now?

James

Thanks for the update James. First, I'd like to clarify a little mistake on my part. The subst command to remove a drive letter doesn't need the drive letter before it, as I stated with 'c:\subst a: /d.' You simply need to type 'subst a: /d' (or whatever the drive letter is in your case).

Second, you're not alone when it comes to forgetting DOS commands. As the text-based OS is rarely by most people these days, even simple commands have been lost from common knowledge. In your example here, you were almost right as 'cd..' will take you back one directory level. To return to the root, however, simply type 'cd\' and you'll be taken to the root of the current drive.

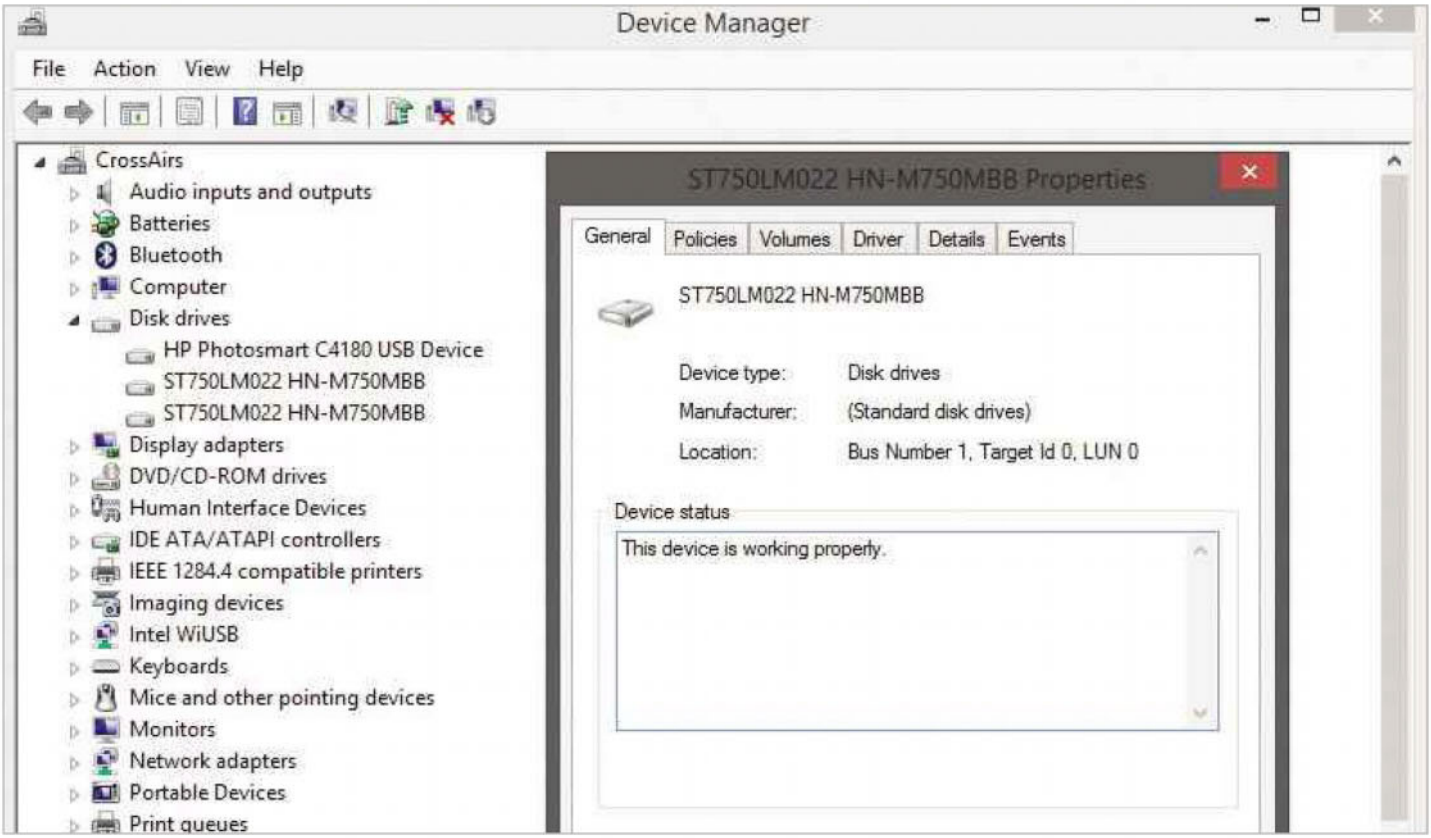
As your phantom drive appears in Disk Management, it's not likely going to be a virtual drive (although that's still possible, as the previous letter this week shows), and it doesn't look like a system reserved volume. The fact that it contains system files and other data is also confusing. Is the drive in question an external model? If this is the case, there have been problems known to be caused by external drives that have operating systems installed on them being added as new drives within Windows, even to the point of being assigned a drive letter. This volume can actually stay mapped. Has the drive in question been used for any other operating systems in the past, and not correctly formatted? If there's some form of boot loader or identifying information on there, it could explain a problem. It's unlikely, but you can't rule anything out.

Another step I'd take is to thoroughly explore the data on the phantom drive itself to try and figure out what it is. You don't need to run any programs or anything, simply look at what's on there. Is any of it familiar? Does any of it exist on your normal system drive. Anything could help shed some light on it.

Another check to run would be to see how many physical drives Windows thinks it has. One way to do this would be to go into Control Panel and Device Manager. Expand the Disk Drives section and look at the drives listed. Are there the right number, or are there any strange entries?

Of course, my suggestion of checking for virus or other malware activity is still relevant. It's not possible to rule this out completely until you've run a full scan, so I strongly recommend you do so if you haven't already. You could even try rolling your PC back to a previous state without the phantom drive.

▼ You can check Device Manager to double-check the drives Windows has installed



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While we try to cover as many questions as we can, we regret that Jason cannot answer your questions personally, but he'll cover as many as he possibly can each week. Please ask one question per letter and remember to include the full specification of your computer, including its operating system.

Jason

Stocking Up

I recently bought a Samsung Galaxy S4 that came with a custom ROM. I don't much like the user interface, and I'm not convinced that some of the functions work properly (notably Bluetooth and GPS). Therefore, I want to flash the stock ROM, the one from Samsung. The S4 is currently at Android 5.0.1 (Lollipop), but it seems there are actually dozens of ROMs, each with a different CSC code. What do these codes mean? Which ROM do I need? The download sites I'm looking at are **www.sammobile.com** and **samsung-updates.com**.

J. Hooper, Derbyshire

I can relate to this – I've seldom had much joy with custom ROMs, either. And while the flashing process is pretty straightforward once you're in the know, much of the information out there assumes the user is already an expert. Anyway, the CSC – carrier sales code – defines the ROM's intended country and network. The common UK codes are shown below.

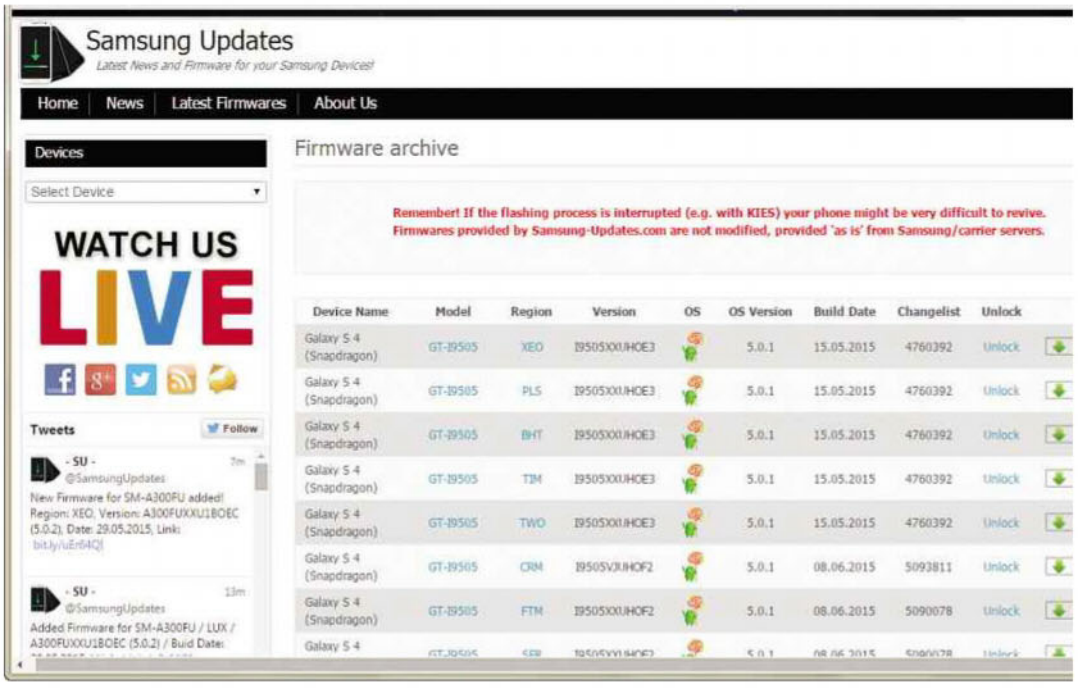
- *BTU (unlocked)*
- *CPW (unlocked)*
- *H3G (3)*
- *O2U (O2)*
- *ORA (Orange/EE)*
- *OXA (unlocked)*
- *TMU (T-Mobile/EE)*
- *TSC (Tesco)*
- *VIR (Virgin)*
- *VOD (Vodafone)*
- *XEU (unlocked)*

Clearly, you need a ROM intended for the UK, but matching up the network isn't so important. For example, a Vodafone ROM should work fine on a phone locked to O2, but you'd end up with the Vodafone splash screen and all the Vodafone-specific bloatware. Not a deal-breaker if you really can't find the 'correct' ROM, but not exactly ideal. Unwanted extras can usually be removed with third-party tools, but the phone needs to be rooted first.

"Most people are after an unlocked ROM"

*Most people are after an unlocked ROM, as those come straight from Samsung, with no modifications or additions. However, don't try this in the hope of circumventing a network lock. Installing an unlocked ROM on a locked phone will *not* remove the lock. Likewise, if you installed a Vodafone ROM on a phone locked to O2 – to use the above example again – you'd not magically be able to use a Vodafone SIM. Generally, a phone's network status is held on an external database, linked to the phone's IMEI.*

Where do you even start?



Character Reference

My Lenovo laptop has developed a crippling problem. Some of the keys on the keyboard don't do anything, and some produce the wrong character or even two characters. My first thought was that a replacement keyboard was in order, but a friend with more experience reckons I'll probably need a new motherboard. The laptop's not even three years old. What are your thoughts?

Howard, Gmail

I doubt the motherboard's at fault, Howard. I agree with your own assessment – the symptoms suggest simply that one or more areas of the keyboard are damaged. The usual cause is a spilt drink, especially a sugary one. Or perhaps there's a problem with the keyboard's ribbon cable, though that's unlikely unless the laptop's been taken apart and clumsy hands have been at work.

I don't know which Lenovo model you've got, so I can't say exactly how the keyboard should be removed. The procedure is broadly similar across all laptops, however. Your best bet is to search YouTube – there's bound to be a video showing how yours (or one like it) comes apart.

For instance, some keyboards are secured by screws hidden beneath a panel below the screen, while others have a retention screw in the laptop's base. Some keyboards use both methods. It sounds more complicated than it is, and it's doable by nearly anyone armed with a standard cross-head screwdriver and good supply of patience. A replacement keyboard will likely cost you no more than a tenner (search eBay). Second-hand ones from reputable sellers are usually good bets too.

There's a small possibility that even with a new keyboard fitted the problem will persist. If that happens, the motherboard will indeed need replacing, as there'll be an issue with the super-I/O chip. I've known this to be the case only once or maybe twice in several hundred repairs.

A new motherboard could cost anything from £30 to a couple of hundred – it depends on the model and the rarity. You'd need to judge whether the expense would be justified. An alternative, Howard, would be to hook up a USB keyboard, as that would by-pass the motherboard's super-I/O chip altogether.

Anyone can replace a laptop keyboard – it's easy, and usually cheap

A Day At The Office

This week, dear readers, I'm going to tell you a story...

A couple of days ago I needed to install Office 2010 Professional Plus on my lad's old laptop. I'd wiped the machine clean and was putting everything back. The product-key sticker was long gone, so I'd retrieved it beforehand with the Magical Jelly Bean Keyfinder: **goo.gl/g91gQc**.

The setup disc was also long gone, but luckily Microsoft provides Office 2010 downloads: **goo.gl/UUytBb**. I entered my key as requested and expected to be off and running. But I fell at the first hurdle, receiving this message: 'The product key provided represents a product which is not eligible for free download.' Huh? Apparently, Professional Plus also isn't eligible for a replacement disc: **goo.gl/EDkrVh**. I had my debit card ready!

Of course, there's a free trial: **goo.gl/Hgbr52**. Surely I could download that and enter my key to unlock it? Er, no – Microsoft explicitly states this isn't possible. What's that all about? In any case, the download link doesn't actually work, presumably because Office 2010 has been superseded.

So I was forced onto the torrent sites. Is Microsoft really unaware of the idiocy of its restrictions? Anyway, I tried over half a dozen downloads – 32-bit, 64-bit, with SP1 or SP2, without SP1 or SP2, cracked, not cracked. Every one gave the same error: 'This is not a valid Office product key.' Grr! It's a known problem, it seems, with its own support page: **goo.gl/dprpoL**. There's even a Fix It tool. Which didn't fix it.

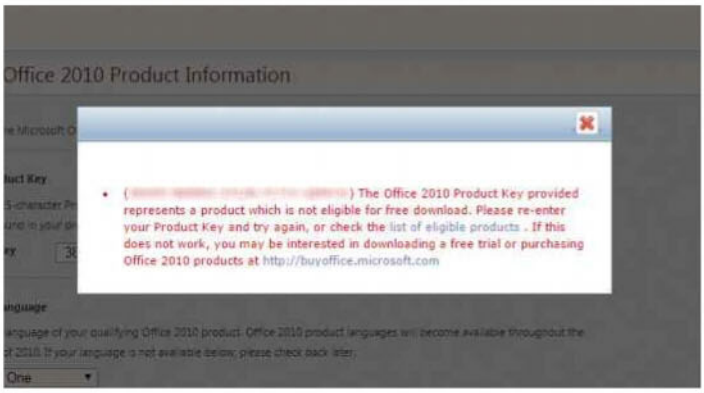
So I took a deep breath and picked up the blower. Microsoft's customer-support number is 0344 800 2400. I spoke to an actual live human. After being cut off the first time, at the second stab – over a terrible line and using the phonetic alphabet (charlie, romeo, alfa, papa) – I got confirmation that my key was valid.

And then the assistant did something completely unexpected. Via a tweaked version of LogMeIn, he uninstalled my somewhat dubious Professional Plus (no questions asked), entered a magic web address, and downloaded and installed a legitimate version direct. My key was accepted! Huzzah!

But I wasn't out of the woods. Even after the chap had activated it, it said it needed activating. Repeated attempts just produced this: 'This product is already activated.' So near yet so far! The fella put me on hold to discuss things with his colleagues, and then he performed some jiggery-pokery that made everything good. I wish I could tell you exactly what he did, but I wasn't watching.

All in all, I was on speakerphone for approaching an hour and a half. Hats off to Microsoft for its extraordinary customer service. But it does make you wonder, doesn't it? Office 2010 Professional Plus used to be available for about £35 to students and families with students, but there were no checks for eligibility, so even companies could buy it. My guess is that Microsoft is now playing games in the hope folks will give up and start subscribing to Office 365.

What the – ?



Crowdfunding Corner

This week, we've got a pair of miniature devices for you to consider – but remember, just because the hardware in this week's crowdfunding projects is small, that doesn't mean their ambition is

Remix Mini: The World's First True Android PC

Android systems may not have taken off as console replacements, with the Ouya presenting an interesting proposition but showing ultimately limited success. But that doesn't mean the same will necessarily happen with the Remix Mini, which bills itself as the world's first true Android PC. After all, if you can turn a tablet into a credible laptop replacement just by adding a keyboard, why not take it a step further?

The Remix Mini uses a custom version of Android, which offers full access to Android software but also has features more commonly seen in Windows, such as a taskbar, multi-window multi-tasking and a mouse cursor. Crammed into a case no bigger than most books, it delivers full 1.2GHz 64-bit CPU power with Ethernet, wi-fi, Bluetooth and USB support.

You can get the remix in two configurations: 1GB RAM and 8GB storage or 2GB RAM and 16GB storage. Both models support 4K HDMI output, have two USB ports, an Ethernet port, a slot for expansible micro-SD storage and a headphone/speaker socket. The cheapest model costs just $30 (£19) and the more powerful one just $40 (£25) for early bird backers. The project's goal of $50,000 (£32,000) has long since been met even with a month and a half to go, so we don't think there's much danger that it won't get made. Shipping is estimated for October this year, and at its current price it seems almost too cheap not to buy.

URL: kck.st/1fLtMVN
Funding Ends: Saturday, 29th August 2015

Sideclick

The Sideclick offers streaming media enthusiasts an extension to their existing remote control so the common problem of being unable to control the master volume or power settings of your TV can be solved without the purchase of an expensive universal remote.

Available in black or silver, the Sideclick is instantly compatible with the Roku, Amazon Fire, Google Nexus Player and Apple TV remotes. The simple design gives easy, lightweight access to power, volume, channel and source/input controls, as well as a pair of programmable bonus buttons that you can bind to your preferred input. The smart-learning feature means you don't have to spend hours typing in codes to get it working with your device. Just push the button on your main remote while the Sideclick is set to learning mode and it'll copy the infra-red instructions instantly, giving it universal capability.

By the time you read this, the cheapest tiers will probably have run out, but you can still get a Sideclick for the bargain price of just £24 (£15). Higher tiers offer discounts on multi-packs of the device, and it'll ship in December of this year, assuming it makes its $80,000 (£51,000) goal which, given that it's hit 50% after just days, seems likely!

URL: kck.st/1LcdRNc
Funding Ends: Thursday, 15th August 2015

Disclaimer: Images shown may be prototypes and Micro Mart does not formally endorse or guarantee any of the projects listed. Back them at your own risk!

App Of The Week

Pro Camera 8

David works on his iPhoneography skills this week

The latest version of the iPhone photo editing app Pro Camera is now available via iTunes for the meagre sum of just £4. If you're not aware of Pro Camera, it's one of the better photo and video editing apps for the new generation of iPhoneographers and iVideoographers that are making the most of the latest technology in mobile photography.

With Pro Camera 8 comes a wealth of features such as ProTimer, which allows you to capture a series of images that can be setup on your iPhone or remotely with an Apple Watch; a remote trigger from your Apple Watch, Advanced HFR video recording, better night photo imaging, a rapid fire burst shot, anti-shake technology and a 6X photo and video zoom.

There's more though, with a vividHDR feature (as an in-app purchase), an exposure swipe control and professional camera controls as you would find on a DSLR.

Features Galore

If that little lot wasn't already enough to pique your interest, Cocologics, the development team behind Pro Camera, has also seen fit to include a photo compasd, which enables you discover where any picture was taken anywhere in the world, as well as a new range of tools for editing any images and the customary ability to share any images across any number of social media sites.

The editing side of things is much improved, with three main feature sets: ProLab, ProFX and ProCut. The feature sets pretty much speak for themselves, but to emphasise, the ProLab element lets you adjust near any aspect of the image. The brightness levels, contrast, saturation and a minutiae of other details are easily altered to enhance your images.

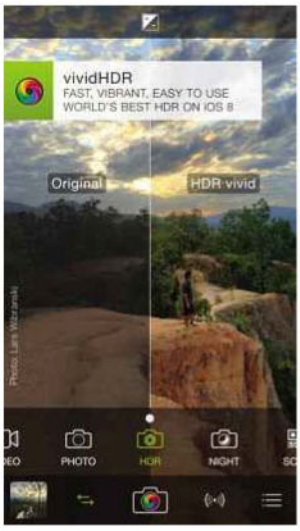
Likewise, the ProFX element can transform an image with a range of filters and effects and allow you adjust the colour, opt for black and white photos or to auto-adjust and optimise the image. Finally, ProCut will let you fine tune the image to better fit any social media site, as well as to straighten the image, change the aspect ratio or even rotate it according to your tastes.

But this is just the tip of the iceberg. This update has crammed a lot more features into an already really good app, and the developers have listened to the feedback from the community to include some much needed extra tools, along with some excellent artistic effects.

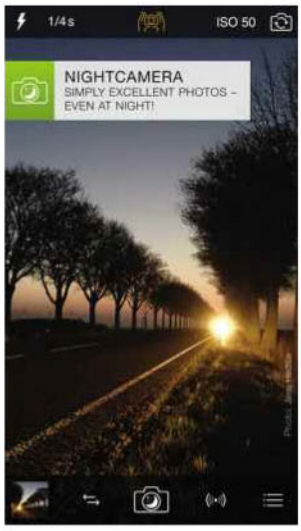
Conclusion

The evolution of the mobile phone as a fully functional all-in-one camera and editing suite has reached the point where even the pros are taking notice. The likes of *National Geographic* and the *New York Times* all hail Pro Camera 8 as one of the best examples of this evolution, and it's not difficult to see why. Obviously you'll need a photographer's eye to get the same kind of images you'd see in a magazine, but thanks to the features within Pro Camera 8 even our poor images manage to look half-decent.

If you take a lot of photos with your iPhone or iPad and you want something more and a little different from the slew of other image editing apps, then we think Pro Camera 8 is just the ticket. It's only £4 and worth every penny.



The in-app purchase HDR feature brings out the colours in an image



Even night and evening shots look superb after being through Pro Camera 8

There are loads of effects and the ability to upload to virtually every social media site

Features At A Glance

- **Photo Compass** – discover where any picture was taken around the world and recapture the experience for yourself.
- **Enhanced Apple Watch Integration** – use your Apple Watch as a remote for ProCamera.
- **Extended Photo Editing Capabilities** – a complete new range of photo editing tools allows you to professionally transform your images.
- **Improved HDR Capture** – quicker processing and auto-save options mean you never lose that perfect picture.
- **ProCamera HD** – the unique app for iPad users specifically optimized for the way people capture images on the iPad.

Logging Off

The selfie-stick, it's a killer, isn't it? No, really it is.

For some time now numerous places have been banning the accessory of narcissists, including such notable locations as the Sistine Chapel in Rome, all Disney theme parks, Mecca and The Van Gogh Museum in Amsterdam. But actually lots of museums and places of spiritual significance have called time on the photo enhancing stick.

However, these limitations were only the start, because some laws coming into force are mostly designed to try to stem the seemingly inexhaustible collection of people who use the stick while putting themselves in life threatening situations.

For example, officials at Lake Tahoe, on the California-Nevada border, are asking visitors not to photograph bears, especially using selfies, because turning your back on a hungry black bear is at best inadvisable and at worst potentially fatal.

Those who just concluded that this is primarily an exclusively American issue, think again, because this is a global phenomenon. There have been so many selfie-related fatalities and serious injuries in Russia that the police there have launched a leaflet campaign spelling out that "A cool selfie could cost you your life."

The track record in Russia is a pretty horrific one, with a woman shooting herself in the head while snapping a shot, and two men dying who wanted to be pictured holding a hand grenade with the pin out.

Yelena Alexeyeva, speaking on behalf of the Russian interior minister said, "Since the beginning of the year we are talking about some hundred cases of injuries for sure."

Across the world people are being electrocuted on tops of trains, falling from bridges, washed out to sea in typhoons, falling off cliffs and while driving their cars, all while trying to take pictures of themselves.

What this reminds me of strongly is a picture that came to my attention while I was doing my degree more than 30 years ago. It was taken in Vietnam by a photographer who took a picture of a man aiming his rifle at him, just before he was fatally shot by the same person.

In that case the picture was a talking point for students to discuss the disconnection that people often experience when recording something, where they become purely an observer, forgetting that they're part of

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what is actually transpiring.

However, the selfie stick problem seems to be driven more by people wanting to get something interesting to stick on their Facebook wall, combined with having zero common sense.

And, to be brutally honest, you don't need to research much to find a remarkably large number of people who can't calculate likely outcomes of their actions, often with serious or even fatal consequences.

How else do you explain those people who drive cars without a seatbelt on, thinking that Newtonian laws of motion don't apply to them? Or the man who died from asphyxiation from a condom he'd pulled over his head to inhale nitrous oxide from. Because for all the legislation and leaflets in the world, there are people out there so stupid that it's amazing they remember to keep breathing.

If you like pictures of yourself, and I don't, then exercise some sort of appropriateness check before deploying your stick – because failure to follow these basic instructions could end up with one picture that will define you for all eternity.

Mark Pickavance

LAST WEEK'S CROSSWORD

Across: **1** Ripe, **3** Compound, **9** Galvani, **10** IPCop, **11** Due Diligence, **13** Titans, **15** Eureka, **17** Premium Bonds, **20** Plane, **21** Morocco, **22** Glossary, **23** Sect.
Down: **1** Rigidity, **2** Pulse, **4** Origin, **5** Prime Numbers, **6** Upcycle, **7** Dupe, **8** Magic Numbers, **12** Passport, **14** Tornado, **16** Summer, **18** Niche, **19** JPEG.

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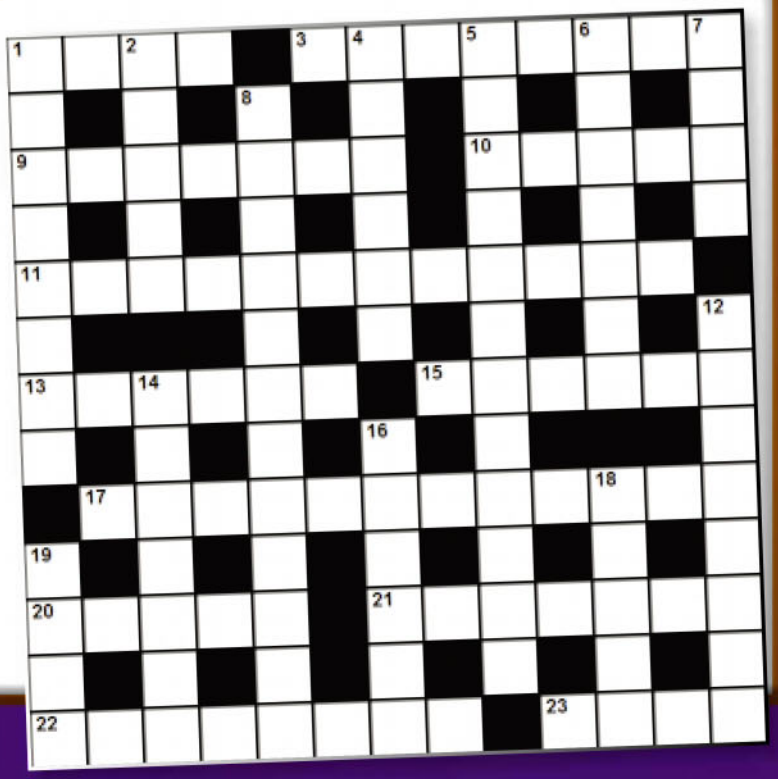
As you will no doubt be aware by now, Harper Lee, the author of To Kill A Mockingbird, has a new book out, which is set after that novel and which features the very same characters. However, readers were shocked to discover that Atticus Finch, the saintly lawyer from that book has somehow become a massive racist in the new novel, Go Set A Watchman. Of course, anyone who looked into this matter for more than five minutes would have discovered that Watchman isn't a new book at all but a rather a very old one, written before Mockingbird. In fact, if anything, it's a draft of that debut novel. But who cares about the truth? Let's all just call it a sequel and get upset about it. Anyway, it got us thinking: maybe more draft versions of successful books and plays should be released. Like the early version of Hamlet, in which his dad actually turns out to be alive still, and the whole thing has been a complete misunderstanding. Or the version of Spot the Dog in which Spot gets done for tax evasion and falls into a spiral of depression and deep fried Mars Bars. We're not saying it's going to happen; we're just saying if it doesn't we won't be that surprised.

THIS WEEK'S CROSSWORD

Across
1 An insurance policy held by a company, which protects against losses resulting from circumstances such as bankruptcy. (4)
3 A line on a diagram or map connecting points relating to the same time or equal times. (8)
9 A machine that converts a coded text into ordinary language. (7)
10 A single instance of periodical literature such as a journal, magazine or newspaper. (5)
11 Accidental contact between two points in an electric device that have a potential difference. (5-7)
13 A series of computers manufactured by Acer. (6)
15 German multinational corporation that designs and manufactures sports shoes, clothing and accessories. (6)
17 Those who believe the universe and living organisms originate from divine acts as in the biblical account, rather than by natural processes such as evolution. (12)
20 .ht TLD. (5)
21 Fictional vampire in a gothic horror novel by Bram Stoker. (7)
22 Roughly translated this video games giant's name is 'Leave luck to heaven'. (8)
23 A tactic or manoeuvre intended to gain an advantage. (4)

Down
1 A formula by which the distances of the first seven planets from the sun are roughly derived in terms of powers of two. (5,3)
2 A tortilla chip topped with cheese and chilli-pepper and broiled. (5)
4 The deformation of a body under an applied load. (6)
5 Happening or existing at the same time. (12)
6 Cancel officially. (7)
7 The state of requiring help or of lacking basic necessities such as food. (4)
8 Insert personal opinions into an objective statement. (12)
12 A general equilibrium of the forces tending to elevate or depress the earth's crust. (8)
14 Relating to the last period of the Palaeozoic era, between the Carboniferous and Triassic periods. (7)
16 Based on pretence; deceptively pleasing. (6)
18 An astronomical observatory in Western New York owned and operated by Alfred University. (5)
19 A Ruby web server based on Mongrel. (4)



In Next Week's Micro Mart*

- The useful things that Microsoft didn't put in Windows 10
- The small Google division coming up with big ideas
- The current state of alternative operating systems
- The very best processors for overclocking
- Plus the usual mix of news, reviews and advice

* May be subject to change